TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS WITH ILLUSTRATED PARTS BREAKDOWN

MAINTENANCE LEVEL(S)

LIQUID OXYGEN CONVERTER P/N 50C-0021-1

ESSEX CRYOGENICS OF MISSOURI, INC.
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FOREWORD

1. PURPOSE OF MANUAL.

This technical manual contains the Operation and Maintenance Instructions with Illustrated Parts Breakdown for the Liquid Oxygen Converter, Part Number 50C-0021-1. As shown in Figure 1-2, the Converter is mobile, aeromedical, air transportable equipment and is to be accorded maintenance management under provisions of AFR 66-1. Only fully trained and qualified personnel will be authorized to operate or handle any equipment involving liquid oxygen. (Reference AFOSH STD 127-67, TO 42B6-1-1, TO 42C-1-11 and TO 00-25-172).

2. PURPOSE OF THE EQUIPMENT.

The 10 liter liquid oxygen capacity equipment covered in this manual is for use in tactical aeromedical missions, either at the Mobile Aeromedical Staging Facility (MASF) or on board C-130 evacuation aircraft, to supply gaseous oxygen to combat casualties.

3. NONSTANDARD ABBREVIATIONS.

Abbreviations used in this manual conform to ASME-Y14.38M.

4. LIST OF RELATED PUBLICATIONS.

List of Related Publications

Number	Title
AFOSH STD 127-67	Liquid Nitrogen and Oxygen Safety
TO 00-20-7	Inspection System, Documentation, and Status Reporting For Support and Training Equipment
TO 00-25-172	Ground Servicing of Aircraft and Static Grounding/Bonding
TO 1-1-691	Corrosion Inspection, Preservation and Control
TO 15X-1-1	Oxygen Equipment
TO 15X-1-3	Painting, Oxygen Equipment
TO 15X2-6-9-3	Overhaul, Liquid Oxygen Converter, Type GCU-24A/A
TO 15X2-6-9-4	Illustrated Parts Breakdown, Liquid Oxygen Converter, Type GCU-24A/A
TO 42B6-1-1	Quality Control of Oxygen Propellant Liquid, Aviator's Liquid Breathing Oxygen, and Aviator's Gaseous Breathing Oxygen

5. TIME COMPLIANCE TECHNICAL ORDERS.

The record of applicable time compliance technical orders is a list of all TCTO which affect the technical content (text or illustration) of this publication.

List of Time Compliance Technical Orders

TCTO Number	TCTO Title	TCTO Date
None.		

SAFETY SUMMARY

1. GENERAL SAFETY INSTRUCTIONS.

This manual describes physical and chemical process which may cause injury or death to personnel, or damage to equipment if not properly followed. This safety summary includes general safety precautions and instructions that must be understood and applied during operation and maintenance to ensure personnel safety and protection of equipment. Prior to performing any task, the WARNINGs, CAUTIONs and NOTEs included in that task shall be reviewed and understood.

2. WARNINGS, CAUTIONS AND NOTES.

WARNINGs and CAUTIONs are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are considered essential to protection of personnel (WARNING) or equipment (CAUTION). WARNINGs and CAUTIONs immediately precede the step or procedure to which they apply. WARNINGs and CAUTIONS consist of four parts: heading (WARNING, CAUTION or Icon [see HAZARDOUS MATERIALS WARNINGS]), a statement of the hazard, minimum precautions, and possible result if disregarded. NOTEs are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are not essential to protection of personnel or equipment. NOTEs may precede or follow the step or procedure, depending upon the information to be highlighted. The headings used and their definitions are as follows:

WARNING

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

CAUTION

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

NOTE

Highlights an essential operating or maintenance procedure, condition, or statement.

3. SAFETY PRECAUTIONS.

WARNING

Observe all safety precautions given here to assure safe and easy handling of cryogenic liquids.

Always connect the flow control valve fitting marked ‘inlet’ to the container assembly oxygen outlet (50±5 psi) and the fitting marked ‘outlet’ to the humidifier. Reverse connection or use of a gas source other than 50±5 psi oxygen may result in inaccurate flow rates and patient injury.

CHAPTER 1
GENERAL INFORMATION

1.1 PROPERTIES OF LIQUID OXYGEN.

Liquid oxygen is a pale blue, nonviscous, waterlike fluid. Liquid oxygen boils at -183° Centigrade (-297°F). At atmospheric pressure it is 1.14 times heavier than water and weighs 9.509 pounds per gallon. For additional information about liquid oxygen, refer to TO 42B6-1-1 (Quality Control of Oxygen Propellant Liquid Oxygen, Aviator's Liquid Breathing Oxygen, and Aviator's Gaseous Breathing Oxygen).

1.2 LIQUID-TO-OXYGEN EXPANSION.

Liquid oxygen, when converted to gaseous oxygen, expands to about 804 times its original volume. One cubic foot of liquid oxygen (7.5 gallons) expands to about 804 cubic feet of gas at 0° Centigrade (32° F) and sea level pressure. Liquid to-gas expansion at atmospheric pressure (21 degrees Centigrade or 70 degrees Fahrenheit) is:

LIQUID OXYGEN AT -183° C (-297° F)	GASEOUS OXYGEN AT 21° C (70° F)
1 liter	860 liters
5 liters	4300 liters
10 liters	8600 liters

1.3 EQUIPMENT DESCRIPTION (FIGURE 1-2).

The Liquid Oxygen Converter P/N 50C-0021-1, as a mobile configuration, is comprised of two units which are the container assembly and the kit assembly. The kit assembly forming a single unit for ease of storage and transportability. Figure 1-3 presents leading particulars of the complete configuration.

1.4 LIQUID OXYGEN HANDLING PRECAUTIONS.

The following precautions must be observed when handling liquid oxygen.

WARNING

- Never allow liquid oxygen to contact the skin. The extreme low temperature of the liquid will immediately freeze the area and severe frostbite may result. If the skin is contacted by drops or splashes of LOX it will freeze skin tissue.

NOTE

Remove patient from exposure immediately. Transport patient to emergency room of hospital/clinic as soon as possible after the exposure to liquid oxygen. Keep patient dry and warm with blankets enroute to the emergency room. Do not attempt to rewarm frozen parts until under proper medical care. Control of shock, pain and rewarming of frozen parts must be provided by medical service.

- Never confine liquid oxygen in any piping or container without adequate safety devices. The pressure build up when the liquid expands to gas will rupture most piping, tubing or containers. Never allow the unit vent line/fitting to be obstructed. The vent line/fitting must remain open at all times.

- Comply with all safety directives. Fifty feet has been established as the safe distance criterion for oxygen equipment. Assure painting and marking on the assembly are maintained as required. Oxygen gas will not burn but it supports combustion of any material which does burn.

- Keep liquid oxygen away from absorbent materials, loose clothing or rags. These materials can trap oxygen gas and later be ignited by a spark from a cigarette or match.

- When liquid oxygen equipment is in use, keep in a well-ventilated area away from all gasoline, kerosene, oil, grease, and other hydrocarbons. These substances are not compatible with liquid oxygen. Spontaneous ignition upon contact with these substances may result. Consult TO 42C-1-11 for liquid oxygen compatible substances. Oxygen is not flammable; however, it will support the rapid combustion of most materials. It reacts violently with the petroleum products listed above; oxygen must therefore be considered dangerous.

- Make sure all tools utilized for oxygen repair are used for that purpose only, stored separately and cleaned as necessary to be maintained free from hydrocarbon contaminants at all times.

- Never mix oxygen with other gases. Never use oxygen in systems intended for other gases; never put anything but oxygen into an oxygen system.

Capacity (LOX)	10 liters
Operating temperature range	-65°F(-54°C) to +260°F (+127°C)
Relief valve setting	100 to 120 psig
Pressure closing valve setting	70 to 80 psig
Delivery rate	120 lpm (min)
Filling time at 70°F (max)	10 min at 30 psig
Buildup time (max)	5 min

Figure 1-1. GCU-24A/A LOX Converter Operating Characteristics

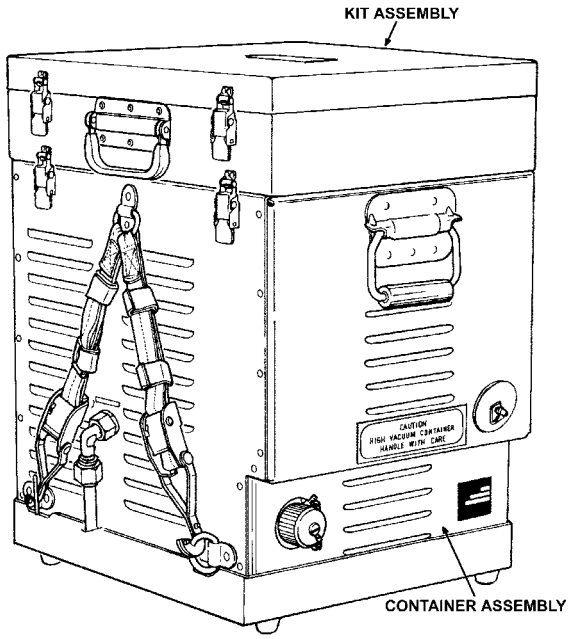


Figure 1-2. Liquid Oxygen Converter P/N 50C-0021-1

Nomenclature . . . . . Converter, Liquid Oxygen
Part No 50C-0021-1
Capacity . . . . . 10 Liters Liquid Oxygen (LOX)
Service. . . . . Three patients
Delivery Rate . . . . . 15 LPM each Patient at 50+5 PSIG (45 LPM Max.)
Temperature:
- Operating. . . . . 40°F to 140°F
- Delivery. . . . . 60°F to 80°F
- Non-Operating (Storage). . . . . -40°F to 140°F

Relief Valve Settings:
- Converter. . . . . 100-120 PSIG
- Supply . . . . . 120-140 PSIG

Rupture Disc Burst Pressure . . . . . 225 PSIG at 72°F
Container Assembly, Liquid Oxygen -
Part No 8661096-10
Overall Dimensions:
- Length . . . . . 18.3 Inches
- Width. . . . . 15.2 Inches
- Height . . . . . 18.5 Inches
- Weight (Empty). . . . . 55 pounds
- Weight (Full) . . . . . 80 Pounds

Electrical Power . . . . . 9 Volt DC Replaceable Storage Batteries (2)
Tiedown Provisions. . . . . 4 Straps (To Aircraft)
Kit Assembly, Accessory-
Part No 50C-0021-0001
Overall Dimensions:
- Length . . . . . 18 Inches
- Width. . . . . 15 Inches
- Height . . . . . 5.5 Inches
- Weight . . . . . 30 Pounds

Contents, 3 Each Item:
- Oxygen Hose. . . . . 20 Feet
- Flow Control Valve . . . . . Adjustable to: 0, .5, 1, 2, 3, 4, 5, 6, 8, 10, 12 and 15 LPM
- Humidification Kit 500ML

Tiedown Provisions. . . . . 4 Interlocks (To Container Assembly)

Figure 1-3. Leading Particulars

CHAPTER 2
SPECIAL TOOLS AND TEST EQUIPMENT

2.1 SCOPE.

This chapter describes equipment recommended to maintain the Liquid Oxygen Converter P/N 50C-0021-1.

2.2 SPECIAL TOOLS.

No special tools are required to maintain the Liquid Oxygen Converter P/N 50C-0021-1. A list of support equipment recommended for maintaining the unit is contained in Table 2-1.

Table 2-1. Special Tools and Test Equipment List

Tool/Equipment No.	Figure No.	Nomenclature	Use and Application
KMU-78/U Per MIL-P-27431 (USAF)		Purge Kit, Converter System, Liquid Oxygen	See Paragraph 5.10.2
TTU-62/E		Fuel/ Oxygen Qty. Tester	See Paragraph 5.23.2
Timeter RT-200		Calibration/ Analyzer 0-20 LPM ±0.5 LPM or 10% whichever is larger (or equivalent)	See Paragraph 5.6.3
MIL-L-25567		Leak Detector	See Paragraph 5.19.3
50C-0001-1		Essex Purge Kit, LOX Converter System	See Paragraph 5.10.3

CHAPTER 3
PREPARATION FOR USE AND SHIPMENT

3.1 SCOPE.

This chapter describes the procedures and precautions to be used in preparing the Liquid Oxygen Converter P/N 50C-0021-1 for use and shipment.

3.2 PREPARATION FOR USE.

NOTE

Aircraft Environmental Maintenance (AFSC 2A6X6) is responsible for inspection and preventive maintenance of LOX converter, but Bio-medical equipment technicians (4A2X1) may be trained by Aircraft Environmental Maintenance (AFSC 2A6X6) or qualified instructors as augmentees for this task.

3.3 CONDITION ON RECEIPT.

The Liquid Oxygen Converter, P/N 50C-0021-1, is shipped from the manufacturer complete with the kit assembly interlocked to the container assembly forming a single unit. The container assembly has been pressurized to a maximum of 25 psig with clean, dry, gaseous nitrogen.

3.4 EXTERNAL SURFACES.

Upon receipt, thoroughly inspect the The Liquid Oxygen Converter, P/N 50C-0021-1, for possible damage or contamination which may have occurred during shipment.

3.5 INSPECTION.

The inspection procedures of Chapter 5 should be performed before use and before the container assembly is filled with liquid oxygen.

a. Inspect the pressure gauge to ascertain that the container assembly has retained a positive pressure of gaseous nitrogen.

b. If the pressure gauge does not register a reading, purge the container assembly in accordance with the procedure presented in Chapter 5.

NOTE

The container assembly LOX filling procedure is contained in Chapter 4.

3.6 QUANTITY INDICATOR BATTERY REPLACEMENT.

The quantity indicator power supply condition should be checked during each servicing of the system container.

a. To verify that indicator storage battery power is available, activate the membrane test switch and observe the reading. The reading should be between 10.00 and 19.99.

b. To replace batteries, remove the battery compartment access panel on the face of the indicator by releasing the four panel retaining screws. Extract old batteries.

c. Insert two new 9V lithium batteries (NSN 6135-01-369-9792).

d. Check operation of indicator for correct “10.00” to “19.99” readout.

e. Reinstall the battery compartment access panel.

f. Replace four access panel retaining screws.

3.7 PREPARATION FOR SHIPMENT.

NOTE

Aircraft Environmental Maintenance (AFSC 2A6X6) is responsible for inspection and preventive maintenance of LOX converter, but Bio-medical equipment technicians (4A2X1) may be trained by Aircraft Environmental Maintenance (AFSC 2A6X6) or qualified instructors as augmentees for this task.

To prepare the Liquid Oxygen Converter, P/N 50C-0021-1, for shipment, proceed in the following manner:

a. Drain all LOX from the Converter container assembly and purge the container assembly in accordance with the procedures presented in Chapter 5.

b. Pressurize the container assembly with dry, water pumped, gaseous nitrogen, Type BB-N-411, to 20±5 psig.

Do not allow petroleum contaminants of any kind to be used or stored on or about these containers.

c. Latch the kit assembly to the top of the container assembly.

CHAPTER 4
OPERATION INSTRUCTIONS

4.1 GENERAL.

The instructions in this chapter are for information and guidance of the personnel responsible for operation of the Converter. The operator shall be completely familiar with, as well as know, the location and purpose of all operating controls and indicating instruments.

4.2 SCOPE.

This chapter contains operating precautions and instructions for use of the Liquid Oxygen Converter P/N 50C-0021-1.

4.3 OPERATING PRECAUTIONS.

WARNING

All of the following precautions shall be strictly observed when handling oxygen or operating the Converter.

All persons who operate the Converter shall be thoroughly familiar with the hazards of oxygen and the necessary safety precautions for the work assigned. TO 42B6-1-1 is are commended source of information concerning storage and handling of oxygen.

4.4 ENVIRONMENTAL SAFETY.

WARNING

- SMOKING. Do not smoke or permit others to smoke within 50 feet of the Converter. Do not carry any source of flame such as matches or lighters around the Converter.

- ABSORBENT MATERIALS. Keep oxygen away from absorbent materials, loose clothing, or rags. These materials can trap oxygen gas and later be ignited by a spark from a cigarette or match.

- HYDROCARBONS. Keep the Converter, the surrounding work area, tools, associated equipment, and clothing as clean as possible and completely free from oil, grease, gasoline, kerosene, and other hydrocarbons. These substances are not compatible with oxygen. Spontaneous ignition upon contact of oxygen with these substances may result. Oxygen gas will not burn but it supports combustion of any material which does burn.

- VENTILATION. Operate and maintain the Converter only in a well ventilated location.

All of the Environmental Safety precautions shall be observed while performing procedures in this manual.

4.5 THEORY OF OPERATION.

The system has the capacity to store ten liters (10L) of liquid oxygen (LOX) and convert the LOX to a gaseous state. The gaseous oxygen is then humidified and delivered at a controlled flow rate to up to three (3) ambulatory or litter patients. The Converter is configured to be carried on-board and tied down to the floor of the aircraft cargo compartment.

a. The Converter container assembly is configured to be filled by externally accepting the CRU-59/A female filler valve from the LOX supply source. The GCU-24A/A Converter within the container assembly stores up to ten liters (10L) of oxygen in the liquid state. The contained LOX volume can be verified by the incorporated contents gauging system.

b. The GCU-24A/A converter converts the LOX to its gaseous form and directs its flow while maintaining pressure at approximately 75 psig. Downstream from the GCU-24A/A converter, heat exchangers are provided to elevate the gas temperature to a delivery temperature ranging between 60°F and 80°F. To prevent a potentially hazardous situation from gas pressure buildup, both a venting relief valve, set at 120 psig and a nominal 225 psig burst disc are incorporated into the GCU-24A/A converter circuit.

c. Additionally, another relief valve, set at approximately 140 psig, is installed in the container assembly plumbing to protect the system from over-pressurization.

d. The pressure regulator, located downstream from the GCU-24A/A converter and heat exchangers, lowers the gas pressure to a nominal 50 psig before it reaches the three (3) supply outlet disconnects located on the upper surface of the container assembly.

e. The nearby pressure gauge continuously registers oxygen delivery pressure.

f. The system is completed by the addition of the components from the kit assembly. The three (3) supply hoses, when inserted into the container assembly disconnect receptacles and attached to the individual flow control valves, provide for the delivery of oxygen at a pressure of 50 psig. With the flow control valves assembled to the humidification kits, therapeutic oxygen flow can be regulated to each patient's mask, in increments, to a maximum rate of 15 lpm.

g. The assembled Converter is capable of delivering the rated oxygen flow during an aircraft rapid decompression condition such as increasing the altitude environment from 8,000 feet ASL to 40,000 feet ASL within one second.

CONVERTER, LIQUID OXYGEN
CRU-87/U
OPERATING INSTRUCTIONS

1. In flight - secure system to floor by attaching straps to cargo tie down rings - pull straps tight.
2. Open supply outlet access door to expose supply outlets. Remove rubber covers from supply outlets with a clockwise twist of the knurled knob.
3. Remove the following items from the accessory kit: supply hose, flow control valve, humidifier and humidifier adaptor.
4. Assemble the humidifier adaptor to the humidifier - attach the flow control valve to the humidifier adaptor – connect the supply hose to the flow control valve - insert the supply hose inlet fitting into the Converter supply outlet – after connecting the mask to the humidifier and the patient, oxygen may be administered by adjusting the flow control valve to prescribed level.

CAUTION

A flow control valve must be connected in line between the system outlet and the patient before administration of oxygen.

5. Replace the rubber covers on the system supply outlets immediately upon removal of the supply hose and close supply access door.

NOTES:

1. A hissing sound is normal when the Converter is venting and should be no cause for concern.
2. For access to the oxygen converter remove the panel from the fill port side.
3. Crews may operate up to 25 ten Liter LOX Converters P/N 50C-0021-1 on the following Military Aircraft: C-5, C-9, C-17, C-130, C-141, KC-10, KC-135, and up to 10 LOX converters on the C-21.

Figure 4-1. Instruction Plate

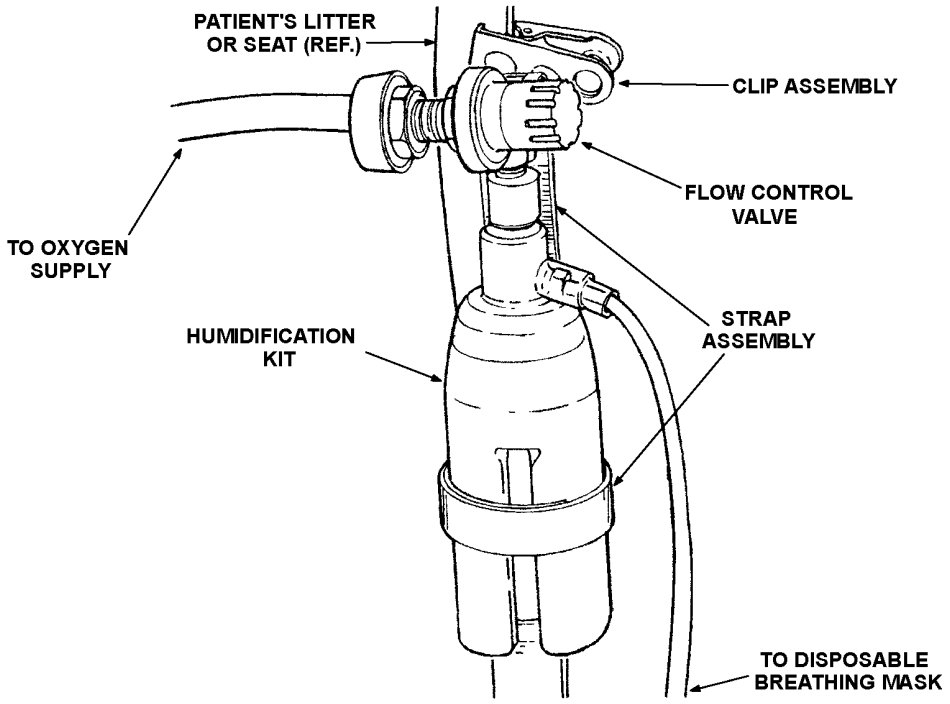


Figure 4-2. Hookup of Control Valve/Clip Assembly, Humidification Kit and Oxygen Hose

4.6 PRESSURE RELIEF VALVE.

As a precaution, a relief valve, set at approximately 140 psig, is installed in the container assembly plumbing to protect the converter from overpressurization. This is in addition to the GCU-24A/A converter's 120 psig relief valve and 225 psig burst disc.

4.7 SERVICING INSTRUCTIONS, SERVICING CHECK LIST, AND OPERATION CHECK LIST/ INSTRUCTIONS.

4.7.1 Servicing Instructions. Instructions pertaining to servicing the container assembly are as follows:

a. Detailed oxygen system servicing instructions are detailed in TO 15X-2-8-1, TO 00-25-172 and TO 15X-1-1.

b. Tools and Equipment (equivalent substitute is authorized).

(1) Tank, Storage, Liquid Oxygen TMU-27/U

(2) Clothing and Equipment, Personnel Protective

(3) Container, LOX Overflow Catch (2 each)

(4) Fire Extinguisher

c. Liquid Oxygen Servicing Procedures.

WARNING

- Liquid Oxygen is extremely cold (-297 degrees F). Contact with skin will freeze tissues.
- Personnel handling liquid oxygen must wear all required protective clothing and devices.
- Only personnel fully trained and qualified in handling and servicing liquid oxygen are authorized to service the container assembly. AFSC 2A5X1 Aircraft Maintenance Specialists (APG) is responsible for servicing the portable LOX container before use/prior to installation in the aircraft.
- All safety precautions contained in pertinent directives will be observed at all times while servicing liquid oxygen.
- No smoking or operation of any internal combustion engine, electrical motor, ground heater or open flame is permitted within 50 ft. of the container assembly being serviced with oxygen.
- Stay clear of the liquid oxygen vents and/or openings during servicing.

- Stand to one side when disconnecting servicing transfer nozzle and/or hose to avoid possible liquid oxygen contact.

4.7.2 Container Assembly Servicing Check List.

NOTE

Make sure AFTO Form 244 is secured to the LOX converter unit for the purpose of documenting historical maintenance records.

a. Check AFTO Form 244 System/Equipment status.

b. Position the container assembly on a stable LOX clean surface approximately two (2) to four (4) feet from ground for servicing with the servicing fill valve down wind and the vent line directed into a LOX drain pan/ can.

c. Static ground the container assembly by connecting it to an approved earth ground connector.

d. Position an aircraft type fire extinguisher up wind approximately ten (10) to fifteen (15) feet from the container assembly.

e. Position the oxygen storage tank trailer at a maximum distance from the container assembly that will allow the oxygen servicing hose to rest on the ground or ramp. Set the trailer hand brake.

f. Static ground the oxygen storage tank trailer to an approved earth ground connector.

g. Position a liquid oxygen drain and overflow catch container under the storage tank trailer.

h. Ascertain that the vent openings of both the oxygen tank trailer and the container assembly are unobstructed.

i. Place a catch container under the container assembly vent tube.

j. Locate container assembly servicing fill valve and remove valve cap.

k. Inspect the container assembly fill valve and the tank trailer servicing hose fill valve for contamination or moisture. Remove any contamination or moisture with a clean lint-free cloth.

l. Pressurize the oxygen tank servicing trailer to forty (40) plus or minus five (±5) PSIG.

m. Open the oxygen tank trailer servicing line shutoff valve (V-3).

n. Purge the servicing hose from LOX servicing tank until liquid oxygen flows from the hose (female). Fill valve attached to purge adapter installed in LOX servicing tank.

o. Connect the oxygen tank trailer servicing hose fill valve to the container assembly fill valve.

NOTE

- Maintain forty (40) plus or minus five (±5) PSI servicing pressure. The container assembly is full when LOX flows from vent in a solid stream, uninterrupted by gaseous spurts.

- Care must be exercised when filling a container assembly that is 75% or more full. A false fill can easily be experienced during the servicing of an almost full unit.

p. When the container assembly is full, close the oxygen tank trailer servicing line shutoff valve (V-3).

q. Disconnect the oxygen tank trailer servicing fill valve from the container assembly fill valve. Depressurize the servicing hose.

WARNING

- To prevent excessive pressure buildup in the servicing hose and possible injury to personnel, insure that the oxygen tank trailer servicing hose is fully depressurized. Open the servicing line pressure relief valve if the oxygen tank trailer is so equipped.

- After filling allow the container assembly to temperature stabilize for a minimum period of thirty (30) minutes prior to transporting or loading in or on any vehicle or aircraft.

r. Re-install the valve capon the container assembly fill valve.

s. Aircraft Environmental Maintenance (AFSC 2A6X6) records the following data on the LOX storage tank trailer AFTO Form 134:

(1) Quantity of liquid oxygen used.

(2) In “Remarks” block - P/N 50C-0021-1 and your initials.

t. In “Ser/ID” block - serial number of P/N 50C-0021-1 serviced.

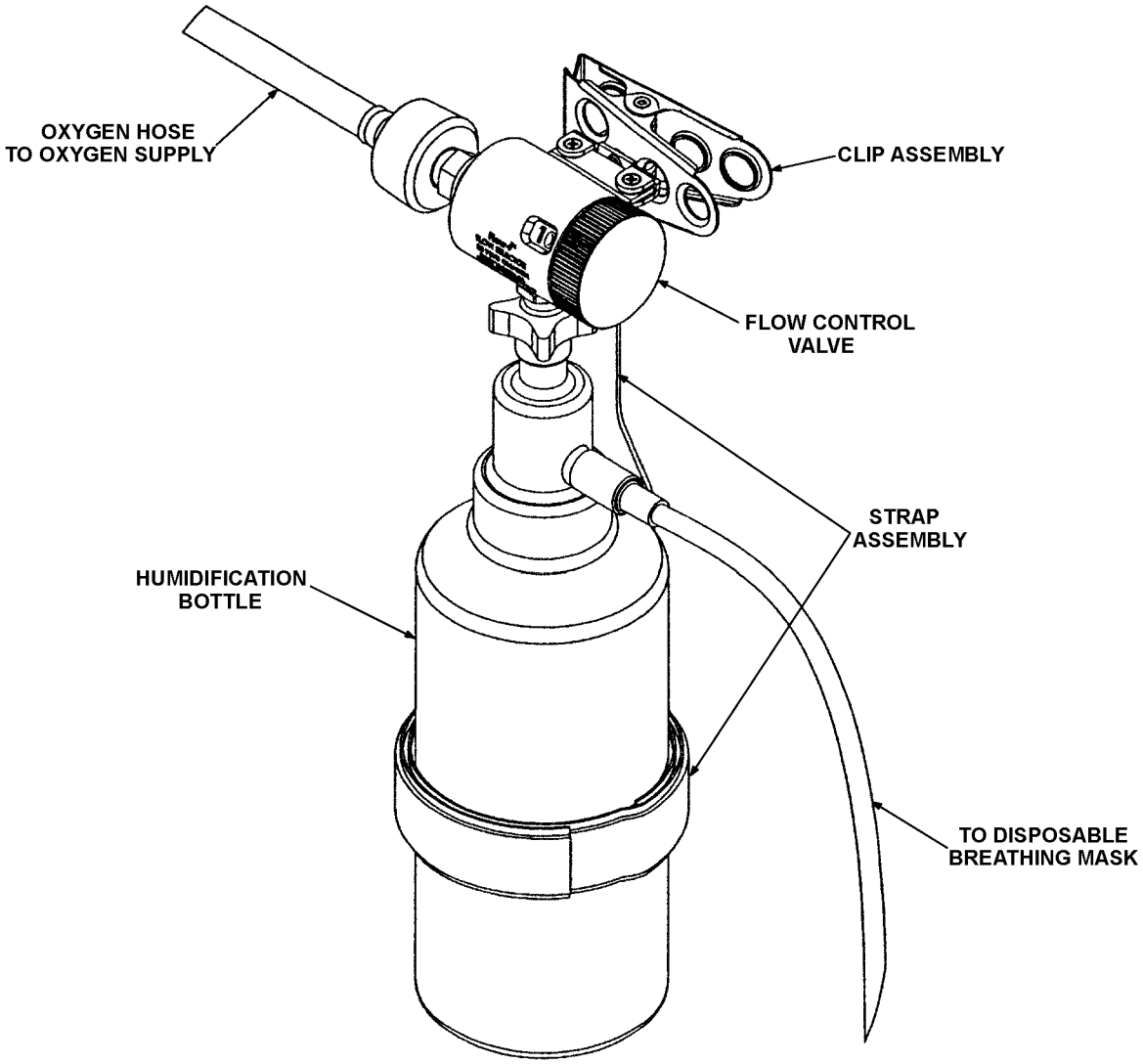


Figure 4-3. Hookup of Control Valve/Clip Assembly P/N 50C-0021-1, Humidification Kit and Oxygen Hose

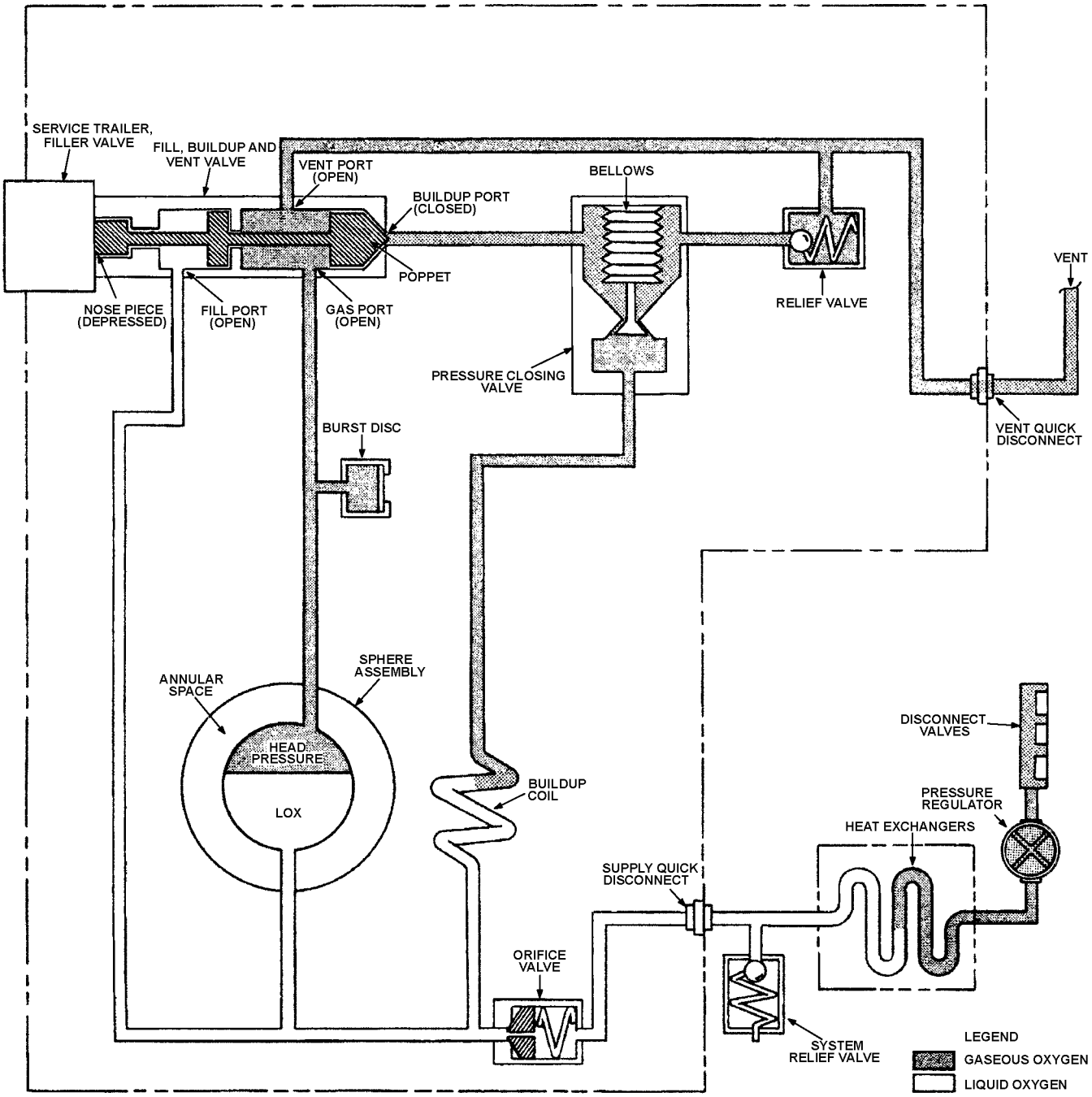


Figure 4-4. Fill Mode

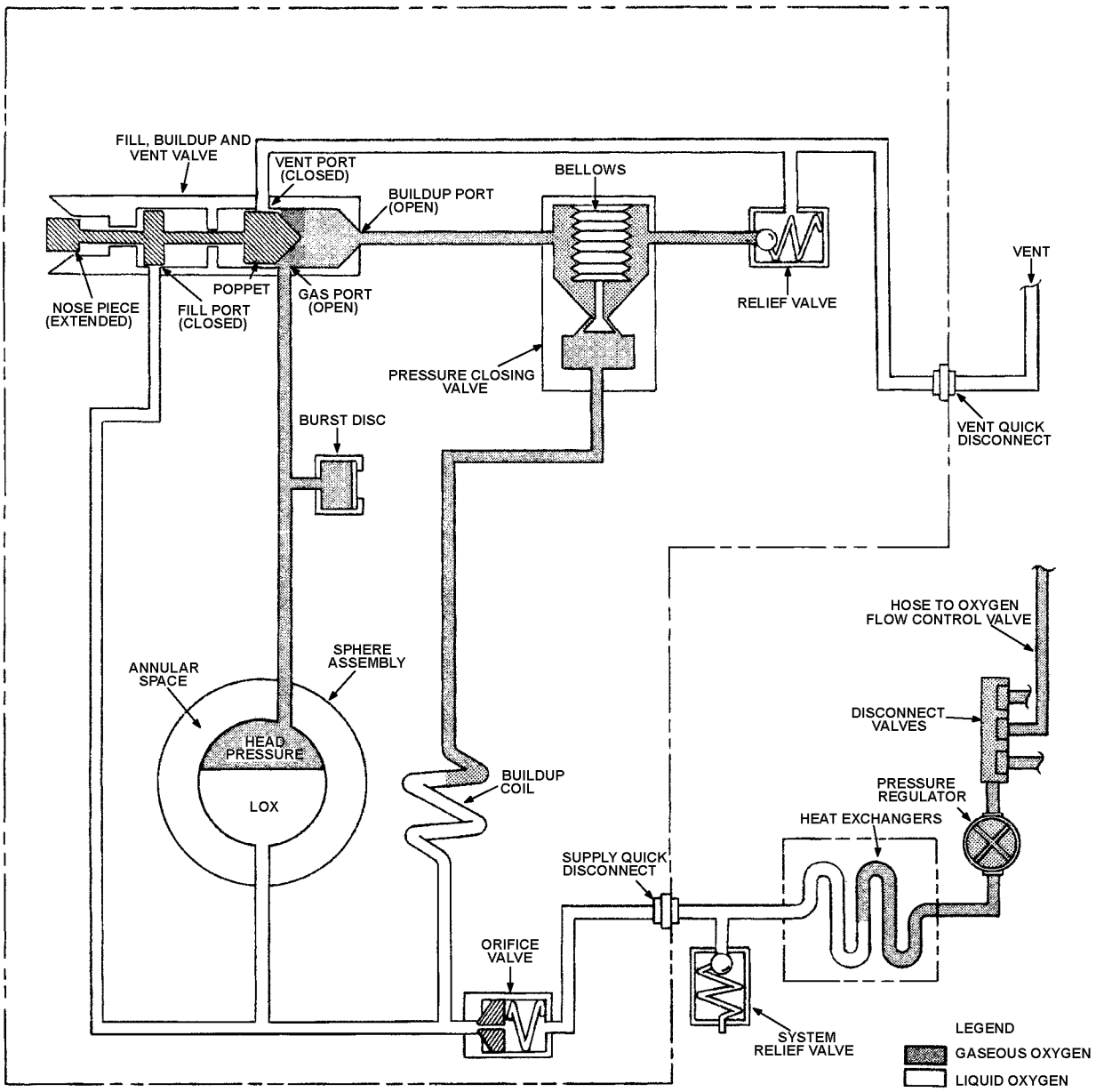


Figure 4-5. Buildup And Supply Mode

4.7.3 Operation Check List/Instructions.

a. Details on the use of oxygen systems, operations and safety precautions are contained in TO 15X-1-1, TO 15X-2-8-1 and applicable Medical Directives.

b. Make sure personnel follow Special Precautions and Warnings on Handling Oxygen. Oxygen under pressure is a friend when used properly but an enemy when handled carelessly.

WARNING

- Only personnel fully trained and qualified in the operation of the CRU-87/U Converter are authorized to use this equipment.
- All safety precautions contained in pertinent directives will be observed at all times when using this equipment.
- Keep oil and grease away!! Do not handle oxygen with greasy hands or clothing. Do not let fittings, hoses, or any oxygen equipment get smeared with oil, grease, hydraulic fluid or dirt. A drop of oil in the wrong place can cause an explosion.
- Never allow the unit vent line and /or fitting to be obstructed. The vent line and/or fitting must remain open at all times.
- When oxygen equipment is in use, keep in a well ventilated area away from all gasoline, kerosene, oil, grease, and other hydrocarbons. These substances are not compatible with liquid and/ or gaseous oxygen. Oxygen is not flammable; however, it will support rapid combustion of most materials. It reacts violently with the petroleum products listed. Oxygen must therefore be considered dangerous.
- Make sure all tools utilized for oxygen repair are used for that purpose only, stored separately and cleaned as necessary to be maintained free from hydrocarbon contaminants at all times.
- Keep oxygen away from fires. A small fire in the presence of oxygen can quickly become a big one. A lighted cigarette in a jet of oxygen will flare up and burst into flame. Carelessness on this score burned up an aircraft and nearly killed a man.
- A hissing sound is normal when the container assembly is venting and should be no cause for concern. If the hissing is excessively loud, continuous, and vapor is seen, discontinue use of unit and remove from service. Turn in unit for maintenance.

c. Follow Liquid Oxygen Converter, P/N 50C-0021-1, Operating Procedure.

(1) Check AFTO FM244, System/ Equipment status.

(2) Load, position, and secure the Liquid Oxygen Converter, P/N 50C-0021-1, to the aircraft floor by attaching the straps to the cargo tie down rings and pull tight.

WARNING

- Do not place the Liquid Oxygen Converter, P/N 50C-0021-1, where it may come in contact with petroleum products as fire and/or explosion may result.
- Never allow the Liquid Oxygen Converter, P/N 50C-0021-1, to be placed where the vent may be obstructed. The vent line and/or fitting must remain open at all times.

(3) Remove the accessory kit from the top of the container assembly.

(4) Check the container assembly indicator for proper liquid oxygen quantity to meet medical requirements (See Table 4-1 PTLOX Conversion Duration Rate).

(5) Check the container assembly pressure gauge for proper operating pressure (50±5 psi).

NOTE

Pressure may indicate higher in stand-by condition. Pressure should never be lower than 45 psi.

(6) Open the access door to expose the supply outlet disconnect receptacles.

(7) Remove the required hoses from the accessory kit.

WARNING

A flow control valve, with index set at zero (0), must be attached to the supply hose outlet fitting prior to inserting the supply hose disconnect into the container assembly supply receptacle. This procedure is imperative to prevent 50 PSIG oxygen from escaping out an open ended hose.

(8) Attach the flow control valve fitting marked INLET to the supply house outlet fitting and set the control valve index mark at zero (0).

(9) Remove plugs, as required, from the container assembly supply disconnect receptacles by turning the receptacle knurled collar clockwise and extracting the plug.

(10) Insert the supply hose quick disconnect fitting into one of the three container assembly unplugged supply disconnect receptacles.

(11) Turn the control valve to the fifteen (15) LPM marking and check that the oxygen delivery pressure does fall below 45 PSIG. Smell the emitted oxygen for any odors. Return meter to zero (0) LPM after test is complete.

NOTE

If any odors other than the hose smell are detected, have other personnel recheck to detect odors. Contact aircraft environmental systems (2A6X6) personnel as soon as possible and report this incident. Do not use this unit! Replace it.

(12) Assembly the humidification kit by attaching the water container to the humidifier adapter.

(13) Attach the flow control valve fitting marked "OUTLET TO PATIENT" to the humidifier adapter. Make sure that the oxygen flow is in the proper direction.

(14) Connect patient oxygen mask to the humidifier assembly.

(15) Install the mask on the patient as required. Oxygen may be administered by adjusting the flow control valve to the following levels: 0, .5, 1, 2, 3, 4, 5, 6, 8, 10, 12 and 15 LPM. (See Table 4-1 for time and/or duration per patient.)

(16) Disassemble the Liquid Oxygen Converter, P/N 50C-0021-1, in reverse order of assembly.

(17) Record any items missing or discrepancy on AFTO Fm 244, System/Equipment Status.

(18) If repairs are required route to the appropriate repair facility.

NOTE

Accessory kit items (medical) will be replaced by the user. Accessory kit item repairs will go to AFSC (4A2X1) Biomedical Equipment Maintenance activity. The container assembly will be routed to Aircraft Environmental Systems (AFSC 2A6X6) personnel for repairs.

4.8 GAUGES AND INDICATORS.

A system line pressure gauge and a LOX quantity indicator are provided on the top surface of the container assembly adjacent to the three supply outlet ports.

a. The pressure gauge registers from 0 to 100 PSIG and, under normal operation, will read 50±5 PSIG. This gauge will continuously monitor container assembly supply line pressure when the converter is either in use or storage.

b. The liquid oxygen quantity indicator has a liquid crystal digital type display that exhibits, from 0.00 to 10.00, the quantity, in liters, of liquid oxygen contained within the GCU-24A/A converter by means of the converter sensing element electrical capacitance. The indicator is normally off and registers quantity only upon energizing the recessed "OPERATE" membrane switch. To verify that indicator storage battery power is available, activate the membrane test switch and observe the reading. This reading should be between 10.00 and 19.99.

4.9 VALVE/CLIP ASSEMBLY.

Each assembly, of which three units are supplied in the kit assembly, is comprised of a flow control valve, a clip assembly and a retaining strap. Hookup of the components is as shown in Figure 4-2.

a. The flow control valve has male threaded connections for the inlet and outlet which are marked accordingly. The inlet on the valve accepts the supply hose from the container assembly and the outlet on the valve attaches directly to the humidification kit.

WARNING

Always connect the flow control valve fitting marked 'inlet' to the container assembly oxygen outlet (50±5 psi) and the fitting marked 'outlet' to the humidifier. Reverse connection or use of a gas source other than 50±5 psi oxygen may result in inaccurate flow rates and patient injury.

b. The clip assembly is used to secure the combined flow control valve and humidification kit to the patient's litter or seat.

c. The retaining strap, of webbing and velcro tape, wraps around both the humidification kit and litter strap for stabilization and elimination of sway while in transit.

d. The adjustable flow control valve selects, from 0 to 15 liters, the quantity of oxygen metered into the humidification kit. Rotate the indexed knob to a detent position exposing the number representing liters of oxygen to be delivered to satisfy the prescribed patient requirement.

4.10 HUMIDIFICATION KIT.

The humidification kit is packaged as two separate disposable units which consist of a container with 500ML sterile water and a sterile humidifier adapter. Assemble together before use.

a. Attach the adapter female threaded fitting to the flow control valve outlet.

b. Slip the flexible plastic tube from the disposable breathing mask over the adapter outlet.

4.11 OXYGEN HOSE.

Three oxygen hoses, twenty feet long and stored on individual racks, are contained within the kit assembly. Each hose has a female threaded connector on one end and a male quick disconnect fitting on the other end. For use, remove the hoses from their rack assemblies and assemble as follows:

WARNING

The following sequence must be followed to prevent oxygen at 50 psig from escaping from the container assembly thru an open ended hose.

a. Attach the threaded oxygen hose fitting end to the flow control valve inlet. Set the valve index at zero.

b. Insert the hose quick disconnect fitting into any of the three quick disconnect receptacles located below the sliding door at the top of the container assembly.

4.12 CONTAINER ASSEMBLY.

The container assembly, Figure 6-1, combines the following items into a single, portable and transportable unit: a standard GCU-24A/A liquid oxygen converter, heat exchangers, relief valve, miscellaneous tubing and fittings, three quick disconnect outlets, quantity indicator, pressure regulator, pressure gauge and tie down provisions.

a. Since this unit contains a GCU-24A/A Converter, the following notice is applicable:

CAUTION

High Vacuum Container, Handle With Care.

WARNING

LOX Vent Port Stand clear when filling or handling. Make sure that a drain pan is in place when filling.

b. The liquid oxygen filling procedure is as outlined in paragraph 4.7. Observe warning of "Overboard Vent" port on the side of the container assembly.

c. Secure the container assembly in accordance with the applicable aircraft TO loading instructions.

d. To facilitate transport and storage of the Converter, the container assembly is provided with four latch fittings to interlock with mating strike fittings on the kit assembly to couple the system into a single unit package.

CAUTION

Keep the container assembly top surface, sliding door closed at all times when the container assembly is not in use to prevent entry of contamination around the three oxygen outlet quick disconnect receptacles.

4.13 CONTAINER ASSEMBLY LOX CONVERTER.

Operational characteristics of the GCU-24A/A liquid oxygen converter, installed within the container assembly, are as follows and as shown in Figure 4-4 and 4-5.

a. Filling the converter is accomplished by attaching the LOX servicing trailer filler valve to the filler port of the fill, buildup and vent valve on the converter. When attached, the servicing filler valve depresses the nosepiece and valve poppet of the fill, buildup and vent valve. This automatically puts the converter into the fill mode (see Figure 4-4).

CAUTION

Place a drip pan under the vent tube assembly outlet prior to the service operation.

b. With the poppet depressed, the fill and vent ports of the fill, buildup and vent valve are opened, and the buildup port is closed. This condition allows gas pressure build up in the inner sphere to vent to the atmosphere. As pressure is vented, LOX in the servicing trailer (which is at a greater pressure, 40±5 psig,) flows through the fill, buildup and vent valve and into the converter.

c. As the LOX level rises in the sphere, pressure created by vaporization of liquid due to heat, turbulence, etc., is vented to the atmosphere. The converter is considered full when LOX flows in a steady stream from the vent tube assembly.

d. When the converter is full and the servicing filler valve is disconnected, the nosepiece and poppet of the fill, buildup and vent valve return to the extended position (see Figure 4-5). This automatically puts the converter into the buildup and supply mode by closing the fill and vent ports of the valve, and opening the buildup port.

e. In the buildup and supply mode (see Figure 4-5), LOX is forced out of the bottom of the inner sphere and into the buildup coil by the weight of the liquid. As the LOX warms and vaporizes into gaseous oxygen in the buildup coil, pressure is created. This pressure is controlled at approximately 75 psig by the opening and closing action of the pressure closing valve.

f. There is a bellows in the pressure closing valve which responds to pressure. This bellows holds the valve in the open position. As pressure builds, the bellows, which senses the increase, contracts (at approximately 75 psig) and closes the valve.

g. Without a demand being placed on the converter, pressure continues to slowly rise. If allowed to go unchecked, pressure in excess of 12,000 psig could be generated. To prevent this potentially hazardous situation, a relief valve, which allows excess pressure to exhaust thru the container assembly vent tube assembly, is incorporated. The relief valve is set to relieve excess pressure in the Converter at approximately 110 psig concurrent with a nominal 225 psig burst disc.

h. As a demand is placed on the converter, LOX is forced into the buildup coil to replace consumed oxygen. As this process is repeated, the LOX level in the converter drops, increasing the void area in the head pressure space of the sphere assembly. As the size of the void area increases, pressure decreases, and is sensed by the bellows in the pressure closing valve. When pressure falls below approximately 75 psig, the bellows expands, opening the valve. With the valve open, pressure from the buildup coil passes through the valve and into the top of the converter. This pressure, coupled with the pressure created by vaporizing LOX contained in the converter, again builds to approximately 75 psig and closes the pressure closing valve. This process is repeated as long as a demand is being placed on the converter.

i. The oxygen supply travels from the GCU-24A/A converter, through the heat exchangers, then through the pressure regulator, and out the container assembly through the disconnect receptacles into the oxygen hoses.

4.14 DURATION OF OXYGEN SUPPLY.

The duration of oxygen supply remaining in the Converter as a function of oxygen content of the Converter and the number of patients supported by the Converter is contained in Table 4-1.

Table 4-1. PTLOX Conversion Duration Rate at 70° Fahrenheit

Liters of LOX	Liters of Gas	Duration of Remaining Oxygen Supply in Minutes at Specified Flow Rate		
		45 LPM	30 LPM	15 LPM
10	8,600	191	287	573
9	7,740	172	258	516
8	6,880	153	229	459
7	6,020	134	201	401
6	5,160	115	172	344
5	4,300	96	143	287
4	3,440	76	115	229
3	2,580	57	86	172
2	1,720	38	57	115
1	860	19	29	57

NOTE: Values based on flow rate to each patient of 15 LPM at 14.7 PSIA and 0°C (32° F).

4.15 LIQUID OXYGEN LOSS DURING STANDBY.

Table 4-2 presents data on the quantity of liquid oxygen typically remaining in the Converter after each of four 24-hour intervals after filling the converter.

Table 4-2. Converter Loss During Standby

Time After Filling - hours	Oxygen Remaining in Converter - liters
24	9.1
48	7.9
72	6.6
96	5.3

CHAPTER 5
MAINTENANCE INSTRUCTIONS

5.1 GENERAL INFORMATION.

This chapter contains instructions essential for maintenance of the Liquid Oxygen Converter P/N 50C-0021-1.

WARNING

Do not use oil, or any material containing oil, in conjunction with oxygen equipment. Oil, even in a minute quantity, coming in contact with oxygen can cause explosion or fire. Dust, lint and fine metal particles are also dangerous.

5.2 MAINTENANCE.

Make sure personnel use proper precautions while maintaining the oxygen equipment listed in Chapter 2.

5.3 TOOLS AND EQUIPMENT.

Only common tools are required to maintain the converter. The recommended support equipment required is listed in Chapter 2.

5.4 SERVICE LIFE.

The Converter, including the GCU-24A/A liquid oxygen converter, can remain in service as long as the system continues to function properly.

5.5 USER MAINTENANCE 4N01.

5.5.1 Kit Assembly. Instructions pertaining to the kit assembly are as follows:

a. Clean interior of kit assembly with a clean, dry, oil and lint free cloth.

b. Attach supply hoses to hose rack assemblies and rewind. Stow in the provided kit slots.

c. Replace any missing or used humidification kits. Three items each are required.

d. Secure caps to flow control valve inlets and outlets. Stow valves in kit and apply caps to hoses.

e. Check general condition of handle, latches and hinges.

f. Accessory kit must be returned with each PT LOX unit when maintenance is due.

5.5.2 Quantity Indicator Battery Replacement. The quantity indicator power supply condition should be checked during each servicing of the system container.

a. To verify that indicator storage battery power is available, activate the membrane test switch and observe the reading. The reading should be between 10.00 and 19.99.

b. To replace batteries, see paragraph 3.6.

5.5.3 General Inspection. Inspect the Liquid Oxygen Converter, P/N 50C-0021-1. Converter operational units at least once a month. When performing general inspection, see Table 5-2 and check the following:

a. Check both container assembly housing and kit assembly case for dents, missing fasteners, condition of latches and tiedowns, chipped paint or other damage.

b. Check gauge and indicator for cracked or broken glass.

c. Check quantity indicator display and battery condition by actuating ‘‘TEST’’ switch.

d. Check container assembly sliding door, over quick disconnect outlet valves, for smooth and positive operation.

e. Check container assembly quick disconnect outlet valves for general condition, for smooth and positive action, freedom from contamination, that protective dust covers are installed and for cleanliness of the surrounding area.

f. Check flow control valves for cleanliness and for smooth operation through adjustments.

g. Check oxygen hoses for end fitting condition, excessive hose wear and flexibility, obvious physical damage and cleanliness.

h. Check kit assembly contents for three each of the flow control valve assemblies, oxygen hoses on racks, and humidification kits.

i. Check humidification kits for sealed purified water packages, complete bottle volume of purified water, sealed humidifier adapter packages, and for obvious physical damage.

5.6 BIOMEDICAL EQUIPMENT MAINTENANCE (AFSC 4A2X1).

The scheduled and unscheduled maintenance to include acceptance inspection, preventive maintenance, and repair of the accessory kit items only is the responsibility of the designated maintenance activity.

5.6.1 Accessory Kit Scheduled Maintenance. (Refer to AFM 67-1, Vol. V, for scheduled maintenance interval).

a. Refer to paragraph 5.5.3, steps f and g.

b. Accessory kit must be returned with each PT LOX unit when maintenance is due.

5.6.2 Accessory Kit Unscheduled Maintenance. If any repairable components of the accessory kit are found to be defective, repair or replace as necessary.

5.6.3 Testing of the Flow Control Valve.

NOTE

The flow control valve delivery rates cannot be adjusted but the rates may be verified for accuracy.

a. To verify the flow control valve flow rates follow these procedural steps:

(1) Fill the container assembly with a quantity of liquid oxygen and allow to temperature stabilize or use Step (9).

The sequence in steps b thru d must be followed to preclude release of oxygen gas at pressure from an unrestricted hose outlet. The system off/on gas flow is controlled by an automatic valve in the receptacle.

(2) Assemble a tee fitting between a supply hose outlet and a flow control valve. Add a master pressure gauge registering from 0 to 100 psig to the tee fitting.

(3) Using a short piece of tubing, connect a rotameter capable of reading from 0 to 20 LPM to the flow control valve outlet.

(4) Set the flow control valve to the ‘‘0’’ flow rate position.

(5) Insert the supply hose male quick disconnect into the container assembly outlet receptacle.

(6) Observe that the master pressure gauge remains within the 50±5 PSIG limits during gas flow.

(7) Set the flow control valve at each of the flow positions and establish that the rotameter reading is comparable to the flow tolerances as described in Table 5-1.

(8) Replace any flow control valve that does not perform to the schedule in Table 5-1.

(9) An alternate test method may be employed by substituting for the container assembly a cylinder of oxygen per MIL-0-27210 with a pressure regulator and gauge in line to the flow control valve and rotameter. Metered gaseous oxygen flow with operating pressure of 50±5 PSIG.

Table 5-1. Flow Control Valve

FLOW POS.	50 PSIG
1	0
2	0.5 +/- .10
3	1.00 +/- .10
4	2.00 +/- .20
5	3.00 +/- .30
6	4.00 +/- .40
7	5.00 +/- .50
8	6.00 +/- .60
9	8.00 +/- .80
10	10.00 +/- 1.00
11	12.00 +/- 1.20
12	15.00 +/- 1.50

5.7 AIRCRAFT ENVIRONMENTAL MAINTENANCE (AFSC 2A6X6).

Aircraft Environmental Maintenance (AFSC 2A6X6) is responsible for performing the tasks outlined in paragraphs 5.8 through 5.10 of this TO.

5.8 INSPECTION AND PREVENTIVE MAINTENANCE.

a. Check LOX fill port for general condition, for smooth and positive action, freedom from all contamination and that the dust cover is in place.

b. Refer to the Inspection Check List in Table 5-2 for a listing of inspection requirements for converter storage, pre-use and operation functions.

5.9 LIQUID OXYGEN DRAIN.

Perform condition inspection and drain all LOX from the converter container assembly before purging the system, upon occurrence of system malfunction, failure of system to pass inspection, when placing container assembly in storage or shipping, or when performing maintenance. To drain LOX proceed as follows:

a. Place the container assembly in an area free from dirt and hydrocarbons.

b. Attach flow control valves, without humidifiers, to the three supply hoses.

CAUTION

The sequence in steps c and d must be followed to preclude release of oxygen gas at pressure from an unrestricted hose outlet. The system off/on gas flow is controlled by an automatic valve in the receptacle.

c. Set all flow control valves to the ‘‘0’’ flow rate position.

d. Insert the supply hose male quick disconnects into the container assembly outlet receptacles.

e. Set all flow control valves on the maximum 15 LPM flow rate position. Total flow will be 45 LPM.

f. Drain time for the full 10 liter LOX capacity system, with three flow control valves set at the maximum rate, will be approximately 3 hours.

g. When draining is complete, disconnect supply hoses from the system and insert plugs into container assembly outlet receptacle valves.

h. After use, converter is serviceable for a maximum period of 14 days without purging.

5.10 PURGING FOR STORAGE.

Purge shall be accomplished when either of the following conditions occur:

a. Prior to storage.

b. When unit has become empty and has warmed to ambient temperature.

c. Unit’s positive gaseous pressure falls below 15 PSIG.

d. Purge is good for 12 months. Attach next purge schedule decal in unit.

5.10.1 Preparation for Purge Sequences. After each scheduled purge sequence, a decal in accordance with Air Force Drawing No. 8427158 will be affixed to the container assembly to serve as an indicator of the next scheduled purge date. Decals can be ordered by processing an AF Form 764.

Table 5-2. Inspection Check List

Storage	Pre-Use	Operation
Container damage and physical condition	Converter damage and physical condition	Converter damage and physical condition
Converter damage and physical condition	Quantity indicator operation	Quantity indicator operation
Container assembly nitrogen storage pressure	Operation of access door assembly	Liquid oxygen content
	Outlet disconnect condition and operation	Oxygen supply pressure
	Lox fill valve condition	System hook-up
	Install quantity indicator batteries	Container assembly retention and security
		Humidification kit retention and security

5.10.2 Purging the Converter System. To purge the converter proceed as follows:

WARNING

Only water pumped nitrogen conforming to (Type 1, Class 1, Grades A or B) or water pumped BB-N-411 dry air conforming to BB-A-1034 (Source 1, Grade A or Source II, Grade C) with water vapor content of less than 0.05 milligram per liter of gas at 70° F and 760 millimeters of mercury pressure will be used as a source for heated segment of this purge procedure. However, a cold purge using Grade 1 gaseous breathing oxygen in accordance with MIL-O-27210 will always be performed immediately after nitrogen or air hot purge, without exception.

CAUTION

While operating purging unit, protective gloves must be worn by operator. Discharge fittings can reach temperature that will cause severe burns if grasped with bare hands.

a. Ascertain the converter assembly is drained and completely empty.

b. Attach the flow control valves only, without humidifiers, to the three supply hoses and set the valves to the 5 LPM flow rate (15 LPM total).

c. Insert the supply hose male quick disconnects into the container assembly outlet receptacles.

d. The following equipment or one of equivalent capacity and performance-is required: Purge Kit, Converter System, Liquid Oxygen, KMU-78/E, per specification MIL-P-27431.

e. With the Converter and a KMU-78/E purge heater positioned on clean work area, connect the approved source product, equipped with shutoff valve and regulator capable of controlling source pressure between 50 to 150 psig, to inlet of a purge heater.

f. Using the female filler connector adapter provided with purge heater, connect purge heater outlet to combination fill, buildup and vent valve on container assembly. Plug KMU-78E power cable into outlet providing electrical source of 115 volts, 60-400 cycle with outlet rating of 500 watts or more.

g. Open the gaseous source shutoff valve and adjust source inlet pressure to approximately 55 psig. Turn purge heater power switch on. Purging gas should exhaust from the container assembly vent tube assembly and from the three flow control valves. The red light on KMU-78E should begin to cycle off and on as purging temperature rises.

h. Continue to hot purge for a minimum of 45 minutes. Then turn purge heater off and cold purge for 15 minutes.

i. Turn purging source off and disconnect all purging appliances and properly store or fill the converter with liquid oxygen in accordance with instructions provided in this text.

j. Replace the fill valve dust cap.

k. Disconnect supply hoses from the container assembly and insert plugs into the outlet receptacle valves.

l. Separate the flow control valves from the supply hoses and install protective dust caps.

m. Return supply hoses and flow control valves to their respective locations in the kit assembly.

n. Check for continuity between the container assembly static ground connector and fill valve. Resistance shall measure less than ten (10) ohms.

Trouble	Probable Cause	Remedy
Converter will not fill	Ice in filler valve or filler line obstructs LOX flow	Thaw filler valve/ filler line
Converter does not fill in required time	Filler line not properly purged prior to filling	Purge and cool filler line
	Converter not sub-cooled before filling	Lower pressure in servicing trailer and sub-cool converter
	Filling pressure too low	Increase pressure to 30 psig at converter inlet
	Defective converter	Return to depot
Frost collects on entire outer jacket of converter	Heat loss due to annular space leakage	Return to depot
Converter will fill only partially(gas only emitted from vent)	Converter not sub-cooled prior to filling	Lower pressure in servicing trailer and sub-cool converter
Converter will not build up	Buildup, vent and filler valve defective, or partially open	Thaw the valve, or return to depot
	Pressure relief valve open	Return to depot
Oxygen supply consumed too quickly	Converter not completely filled during filling operation	Refill Converter
	System leakage	Locate and repair leaks
	Fill, buildup and vent valve partially open venting gas	Thaw valve
Filler line cannot be disconnected from filler valve	Filler nozzle frozen to filler valve	Thaw nozzle
Low, or no converter pressure	System leakage	Locate and repair leaks
	Pressure closing valve out of adjustment	Return to depot
Quantity Indicator indicates empty	Converter empty, defective probe or quantity indicator	Refill, replace Converter indicator batteries or indicator
Quantity Indicator - no reading	Dead batteries	Replace indicator batteries
LOX Converter contaminated	Undesirable odors or moisture	Purge Converter

Figure 5-1. Liquid Oxygen Converter, P/N 50C-0021-1 Troubleshooting Procedures

5.10.3 Instructions for Purging the LOX. To purge the LOX converter using Essex Purge Kit P/N 50C-0001-1, proceed as follows:

WARNING

Only gaseous nitrogen conforming to Type I, Grades A or B, Class 1 of A-A-59503 will be used as a source for heated segment of this purge procedure.

CAUTION

While operating purging unit, protective gloves mist be worn by operator. Discharge fittings can reach temperature that will cause severe burns if grasped with bare hands.

a. Ascertain the converter assembly is drained and completely empty.

b. Attach the flow valves only, without humidifiers, to the three (3) supply hoses and set the valves to the 5 LPM flow rate (15 LPM total).

c. Insert the supply hose male quick disconnect into the container assembly outlet receptacles.

d. The following equipment, or one of the equivalent capacity and performance is required: Purge Kit, Converter System, Liquid Oxygen, Essex P/N 50C-0001-1.

e. With the converter and a purge heater positioned on a clean work area, connect the approved source product, equipped with a shutoff valve and regulator capable of controlling source pressure between 50 - 150 psig, to inlet of a purge heater.

f. Using female filler connector adapter provided with the purge heater, connect purge heater outlet to combination fill, buildup and vent valve on container assembly. Plug purge heater power cable into outlet providing electrical source of 115 volts, 60-400 cycle with outlet rating of 500 watts or more.

g. Open the gaseous source shutoff valve and adjust source inlet pressure to approximately 55 psi. Turn the purge heater power switch on.

h. Continue to hot purge for a minimum of 45 minutes. Then turn purge heater off and continue to cold purge for 15 minutes.

i. Ascertain with a thermometer that exhaust temperature is equal to or below ambient temperature. If not, additional cold purging will be required.

j. Set the flow control valves to zero.

k. Disconnect purge heater adapter from converter, trapping pressure inside converter.

l. Turn purging source off, then disconnect and store all purging devices.

m. Adjust the knob on one of the flow control valves assemblies to vent the system pressure to 35 to 40 psi as indicated on the outlet pressure gauge.

n. Disconnect oxygen supply hoses from container assembly and insert dust plugs back into the oxygen outlet valve receptacles.

o. Separate the flow control valves from the oxygen hoses, re-install all protective dust caps, and then properly store the components into their respective locations in the accessory kit.

p. Replace the fill dust cap.

q. Check for continuity between the container assembly static ground connector and fill valve. Resistance shall measure less than 10 ohms.

5.11 TROUBLESHOOTING.

Refer to the Troubleshooting Procedure in Figure 5-1 for a listing of possible troubles that maybe encountered during operation, the possible cause, and the recommended remedies which must be taken to isolate and correct the trouble.

5.12 REPAIR.

CAUTION

Any component that is exposed to gaseous oxygen and which does not proceed immediately into the next repair step shall be plugged and bagged to prevent contamination.

The above precaution shall be observed while performing procedures in this manual.

5.13 PREVENTION OF DAMAGE.

During disassembly and subsequent handling of components, care should be exercised to avoid damage. Use particular care to avoid damaging the converter high vacuum container.

5.14 DISASSEMBLY OF CONTAINER ASSEMBLY.

a. During disassembly, cleaning, and inspection, insure that working tools and environment are maintained in a high state of cleanliness. Any component which ordinarily comes in contact with LOX should be overhauled in an area in which better than normal housekeeping is maintained to reduce the possibility of contamination. Spontaneous ignition upon contact of LOX with any substance not compatible with LOX may result when the container assembly is refilled. Consult TO 42 C-1-11 for LOX compatible materials.

b. If the container assembly has a quantity of LOX, measurable by the liquid quantity indicator, drain the system as described in paragraph 5.6.

Purge container assembly before doing any work which requires disassembly of lines, valves and/ or indicators.

5.14.1 Component Disassembly. Proceed as follows to achieve access and to disassemble all components and items of the container assembly.

a. Remove screws securing cushioning feet to bottom of container assembly and detach drip pan.

b. Remove the exterior screws retaining the front panel and remove the panel.

c. Remove the exterior screws retaining the rear panel and remove the panel.

5.14.2 Removal of the GCU-24A/A LOX Converter. The GCU-24A/A LOX converter is removed in the following manner:

a. Detach the flexible supply and exhaust hose quick disconnects from the converter.

b. Release the two capacitance probe connectors from the converter and quantity indicator. Store for re-use.

c. Remove the retaining nut and fitting from the center of the converter base plate.

d. Slide the converter out of the rack and from the container assembly.

5.14.3 Removal of the Double Heat Exchangers.

Removal of the double heat exchangers can be accomplished through access from the rear of the container assembly as follows:

a. First release both inlet and outlet tubing nut connections from each of the heat exchangers.

b. Extract the heat exchangers from the container assembly after removing four screws each that mount the heat exchangers to the structural supports within the container assembly.

c. Cap off all heat exchanger and tube openings.

5.14.4 Removal of the Supply Valve. The supply relief valve, accessible from the front after removal of the converter, is secured to the container assembly bottom panel and is removed as an assembly of valve, nipple, tee and two elbow fittings.

a. Release the flexible supply line tube, from the GCU-24A/A converter, at the elbow fitting.

b. Disconnect the rigid outlet line tube nut from the other elbow.

c. Release the clamp, around the relief valve, from the container assembly bottom panel and remove the assembly.

d. Cap off all openings to prevent contamination.

5.14.5 Removal of the Pressure Regulator. Removal of the pressure regulator and pressure gauge assembly, including elbow fitting, is achieved by access from the container assembly front.

a. Detach the inlet and outlet tubing nuts from the elbow fittings in the pressure regulator.

b. Remove the three screws and nuts retaining the pressure gauge to the container assembly top surface.

c. After removing the assembly from the container assembly, separate the pressure gauge from the pressure regulator and the elbow fittings from the regulator.

5.14.6 Removal of the Quantity Indicator. Removal of the quantity indicator is effected by ingress from the front of the container assembly.

a. Disconnect the B and E polarity electrical wire connectors from the indicator.

b. Remove four screws that retain the indicator to the top of the container assembly and extract the indicator.

5.14.7 Container Assembly Parts Removal. The supply disconnect receptacle valves, manifold and housing assembly are removable from the container assembly as a unit, with access from the front of the container assembly.

a. Remove the manifold supply tube assembly between the pressure regulator and the manifold assembly.

b. Remove twelve screws from the top of the container assembly that retain that the housing and extract the complete assembly through the front of the container assembly.

c. Release the three tubing nuts holding the manifold assembly to the disconnect receptacles.

d. Separate the three supply disconnect receptacle valves from the housing assembly by removing four mounting screws and nuts each.

e. Cap off and seal all openings to prevent contamination of parts.

5.14.8 Removal of the Oxygen Exhaust Hose Assembly. The oxygen exhaust hose assembly may be removed from the container assembly in the following manner:

a. Remove the vent tube assembly and elbow from outside the container assembly.

b. Remove the retaining nut and washer from the vent elbow and separate from the panel assembly.

c. Detach the oxygen exhaust hose assembly from the vent elbow.

5.15 OVERHAUL OF THE GCU-24A/A LIQUID OXYGEN CONVERTER.

All instructions pertinent to overhaul of the GCU-24A/A Liquid Oxygen Converter unit in the container assembly are published in Technical Manual, USAF TO 15X-2-6-9-3.

WARNING

Drichlorotrifluoethane may affect skin, eyes and respiratory tract. Perform operations in a well ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames. Use approved personal protective equipment (goggles/face shield) when using compressed nitrogen. Pressure is restricted to less than 30 psi. Provide protection from flying particles. Do not direct airstream toward self or other personnel.

5.16 CLEANING.

a. Clean all metal connectors, couplers, fittings, heat exchangers, relief valve and tubing with drichlorotrifluoethane cleaning compound (MIL-C-81302). Do not soak for prolonged period. Flush through small diameter holes using polyethylene squeeze bottle containing cleaning compound. Blow dry with dry, oil free, nitrogen (Fed. Spec. BB-N-411).

b. Clean remaining components such as case, panels in a solution of soap and water. Rinse in clear water and blow dry with dry, oil free, nitrogen (Fed. Spec. BB-N-411).

c. Remove all anti-seize tape from threaded fittings to prevent entry of tape particles into system.

5.17 REPAIR OR REPLACEMENT.

a. Carefully repair minor thread damage. If thread repair causes loose fitting parts, replace.

b. Replace parts if damaged or worn to the extent that sealing action or usability are affected.

c. Replace tubing if damaged.

d. Clean repaired or replacement parts prior to reassembly.

5.18 REASSEMBLY OF THE CONTAINER ASSEMBLY.

a. Perform reassembly in an area suitable for maintaining cleanliness.

b. Reassemble the Converter container assembly in reverse order of disassembly.

5.19 CALIBRATION AND TESTING.

5.19.1 General. Information pertaining to calibration and/or testing of the Liquid Oxygen Converter, P/N 50C-0021-1, is as follows:

a. Alternate test methods and test apparatus can be used if they provide the necessary accuracy and are compatible with the respective system requirements.

b. Consult Technical Manual USAF TO 00-20-14-WA-1 for information and procedures on repair, calibration, and certification of precision measurement equipment.

c. Calibration or testing of listed Converter components should be accomplished every 12 months or sooner as usage factors and operational conditions require. The components should be calibrated or tested anytime it is suspected or known that they are operating or indicating inaccurately.

d. Calibration or testing should be accomplished in a clean, controlled environment and the results recorded and maintained as specified in TO 00-20-14-WA-1 or other applicable specification. The equipment should not be allowed to become contaminated or come into contact with oil, grease, dirt, or other hydrocarbons or contaminants.

e. All components should be maintained in a clean condition and properly packaged for storage or shipment prior to installation into the Converter. The components should not be installed into a Converter until it has been determined that they are clean and free of hydrocarbons.

5.19.2 Components for Calibration or Testing Procedures. Calibration or testing procedures are prescribed for the following components of the Liquid Oxygen Converter, P/N 50C-0021-1.

Container Assembly
Flow Control Valves
GCU-24A/A LOX Converter
Pressure Gauge
Pressure Regulator
Quantity Indicator
Oxygen-Pressure Relief Valve - Type V

5.19.3 Leakage Test of the Container Assembly.

a. The container assembly, including all fittings and tube connections, shall be subjected to a pneumatic pressure of 95 psig as follows: With the front panel assembly removed, with the GCU-24A/A converter outside the container assembly, with the vent coupling and capacitance gauge cable assemblies separated, and with the supply coupling connected, adjust the pressure regulator to its maximum pressure setting. A pneumatic pressure of 95 psig shall be simultaneously applied to the GCU-24A/A converter test port and one of the AN6024-6 filler valves.

b. While the test pressure is maintained, all fittings and connections shall be examined for leakage by application of leak detector compound conforming to MIL-L-25567. Return the pressure regulator setting to its original setting (50 ±5 psig). Care shall be taken to remove all traces of leak detector compound from the container assembly after the test is performed.

c. The container assembly, including all fittings and tube connections, shall exhibit no evidence of leakage when pressurized to the level specified.

5.20 TESTING OF THE LIQUID OXYGEN CONVERTER.

The testing procedure for the GCU-24A/A Liquid Oxygen Converter unit contained within the container assembly is defined in Section III of Technical Manual USAF TO 15X2-6-9-3.

5.21 CALIBRATION OF THE CONVERTER PRESSURE GAUGE.

NOTE

The pressure gauge cannot be recalibrated but may be checked for accuracy only.

To check the pressure gauge calibration perform the following procedural steps:

a. Fill the container assembly with a quantity of liquid oxygen and allow to temperature stabilize.

The sequence in steps b thru e must be followed to preclude release of oxygen gas at pressure from an unrestricted hose outlet. The system off/on gas flow is controlled by an automatic valve in the receptacle.

b. Assemble a tee fitting with a calibrated master pressure gauge registering from 0 to 400 psig and a male and female quick disconnect fitting. Insert the tee assembly into one of the three quick disconnect outlet receptacles and cross check reading on each gauge.

c. Attach a system flow control valve to a supply hose.

d. Install flow control valves on the two remaining supply hoses.

e. Set all flow control valves to the “0” flow rate position.

f. Insert the supply hose male quick disconnects into the container assembly outlet receptacles and the assembly of step b.

g. Set all flow control valves on the maximum 15 LPM flow rate position. Total flow will be 45 LPM.

h. Assure that the pressure indication has stabilized on the master pressure gauge.

i. If the container assembly pressure gauge differs beyond ±5 psig from the master pressure gauge, remove and replace, then recalibrate the container assembly gauge.

5.22 PRESSURE TESTING AND SETTING OF THE PRESSURE REGULATOR.

The pressure regulator maybe tested and/or adjusted while installed in the container assembly. However, the container assembly front panel must be removed to provide access. Use the following procedure:

a. Remove screws (22) about the periphery of the container assembly front panel and remove panel.

b. Fill the container assembly with a quantity of liquid oxygen and allow to temperature stabilize.

CAUTION

The sequence in steps c thru f must be followed to preclude release of oxygen gas at pressure from an unrestricted hose outlet. The system off/on gas flow is controlled by an automatic valve in the receptacle.

c. Assemble a tee fitting with a calibrated master pressure gauge registering from 0 to 400 psig and a male and female quick disconnect fitting. Insert tee assembly into one of the three quick disconnect outlet receptacles and cross check reading on each gauge.

d. Attach a system flow control valve to a supply hose.

e. Install flow control valves on the two remaining supply hoses.

f. Set all flow control valves to the “0” flow rate position.

g. Insert the supply hose male quick disconnects into the container assembly outlet receptacles and tee assembly of step c.

h. Set all flow control valves on the maximum 15 LPM flow rate position. Total flow will be 45 LPM.

i. Assure that the pressure indication has stabilized on the master pressure gauge.

j. To unlock the pressure regulator adjuster, pull the red ring outward from the regulator body.

k. Rotate the outer black knob in the direction required until the master pressure gauge reads as close to 50 PSIG as possible. The maximum pressure tolerance must not exceed plus or minus 5 PSIG.

l. After setting the pressure with the prescribed oxygen flow, return the regulator red ring inward toward the body to lock setting in place.

m. Disconnect the supply hoses from the system container assembly receptacles.

n. Separate the master pressure gauge from the set-up and return the flow control valves and hoses to the kit assembly case.

o. Reinstall the front panel on the container assembly.

5.23 CALIBRATION OF THE CONVERTER QUANTITY INDICATOR.

5.23.1 Calibration by Weight. The quantity indicator can be calibrated using the procedure contained in paragraph 5.23.2. However, the general accuracy of the indicator can be determined in the following manner:

a. Ensure that all LOX has been drained from the container assembly. Note that the quantity indicator registers zero by actuating the membrane “OPERATE” switch.

b. Place the complete container assembly on an accurate scale of at least one hundred pounds capacity. Record the true weight of the empty container assembly.

c. Fill the container assembly to capacity with liquid oxygen and allow the filled container assembly to stabilize for a few minutes.

d. Remove the liquid oxygen from the container assembly in five equal increments of two liters each (use the weight of liquid oxygen as 2.512 pounds per liter). Note the weight of the contained oxygen and the oxygen quantity indicated on the indicator at each level.

e. The values displayed by the indicator shall be within the maximum and minimum limits derived from the following equations:

$$l_{max} = \frac{2.33W + 1.5}{5.753}$$

$$l_{min} = \frac{2.25W - 1.5}{5.753}$$

where l = indicator liquid oxygen content reading in liters

W = exact weight of the liquid oxygen in pounds at the test point

NOTE

A temperature coefficient of an additional 0.05 liter shall be applied to the above maximum and minimum limits for each 30° F interval temperature shift from 70° F.

f. If the indicator inaccurately registers the contents at any level, recheck the battery power supply or replace the indicator.

5.23.2 Calibration Using the TTU-62/E Tester or Equivalent. The quantity indicator can be calibrated using the TTU-62/E Tester or equivalent. The accuracy of the indicator can be determined in the following manner:

a. Connect the tester to the converter probes in accordance with the tester technical manual. The reading should be within the limits in TO 15X-1-1, Section VIII, Figure 8-4, 10 Liter Capacitance Chart.

b. Connect the tester to the quantity indicator in accordance with the tester technical manual. Set the tester to read empty capacitance: 121.9 MIN to 125.1 MAX UUF. Check that the quantity indicator registers zero (0) by depressing the “OPERATE” switch.

NOTE

Adjust the quantity indicator as required to obtain a zero reading using the internal adjustment screw accessible after removing the right hand seal screw on the outside of the indicator.

c. Set the tester to read full capacitance: 170.4 MIN to 175.4 MAX UUF. Check that the quantity indicator registers full, 10.00 liters, by depressing the “OPERATE” switch.

NOTE

Adjust the quantity indicator as required to obtain a full reading using the internal adjustment screw accessible after removing the left hand seal screw on the outside of the indicator.

d. If the indicator inaccurately registers the contents at any level, recheck the battery power or replace the indicator.

5.24 CALIBRATION AND TESTING OF THE OXYGEN PRESSURE RELIEF VALVE.

Calibration and testing of the oxygen pressure relief valve can be accomplished only with the valve removed from the container assembly plumbing. The procedure for calibrating and testing this Type V oxygen pressure relief valve with an operating range of 120-140 psig is defined in Section VII of Technical Manual USAF TO 15X-1-1.

5.25 PREPARATION FOR STORAGE.

To prepare the Liquid Oxygen Converter, P/N 50C-0021-1, for storage, proceed in the following manner:

a. Drain all LOX from the Converter container assembly.

b. Purge the Converter container assembly.

c. Pressurize the container assembly with pumped gaseous nitrogen, Type I, Grade A or B, Class 1 of A-A-59503, to 40 ±5 psig.

d. Remove batteries (2) from quantity indicator and reinstall battery access cover.

e. Remove the humidification bottles (3) from the accessory kit to preclude freezing in a non-climate controlled environment.

f. Seal the LOX in a plastic bag as needed.

CAUTION

Do not allow petroleum contaminants of any kind to be used or stored on or about these containers.

g. Mark the storage container exterior as noted in the caution above.

CHAPTER 6
ILLUSTRATED PARTS BREAKDOWN

SECTION I FOREWORD

6.1 PURPOSE AND SCOPE.

This chapter contains the Illustrated Parts Breakdown (IBP) and is used for requisitioning, storing, issuing, identifying parts, and for illustrating assembly and disassembly relationshops. This IPB is not intended to be used as an authority for procedure of disassembly or assembly. Maintenance or repair should be performed by authorized personnel using the applicable maintenance instructions.

6.2 MODELS COVERED.

This Illustrated Parts Breakdown (IPB) lists and describes items necessary for support of the Liquid Oxygen Converter, P/N 50C-0021-1.

6.3 FINDING PART NUMBERS, ILLUSTRATION, DESCRIPTION.

a. How to find a part number or description using the TOC and illustration titles.

b. How to find the illustration or description if a part number or reference designation is known.

6.3.1 Maintenance Parts List (MPL). The MPL is separated into figures by main groups or assemblies and keyed to associated illustrations by figure and index numbers. In general, assemblies and parts installed at time end item(s) was manufactured are listed and identified in this manual. When an assembly or part (including vendor items), which is different from original, was installed during manufacture of later items, series or blocks, all assemblies and parts are listed (and usable on coded). However, when original assembly or part does not have continued application (no spares of original were procured or such parts are no longer authorized for replacement), only preferred assembly or part is listed. Also, when an assembly or part was installed during modification and original does not have continued application, only preferred item is listed. When a standard part can be replaced with an oversize or undersize part, the latter parts, showing sizes, are also listed.

6.3.2 Figure Index and Sheet Number. The figure number shall precede the first index number in each listing and the first index number on each page of a multi-page listing, but shall not be repeated before each subsequent index number. Index numbers shall be listed in sequence. When the same part appears more than once on an illustration, and is part of different assemblies or subassemblies, or it is otherwise necessary to list it more than once, each listing shall be assigned a different index number. An index number shall not be assigned to an assembly when the detail parts are indexed unless the assembly is shown or circle shows which parts comprise the assembly. When a change to an end item requires addition of parts to a listing and illustration, the index number shall be the same as the preceding index number with an added decimal number, e.g. 22.1, 22.2, etc.

6.3.3 Part Number Column. This column contains part numbers, including dash numbers, assigned to each listed part in accordance with current industry engineering practices. The appropriate numbers for the type, model, specification, specification control drawing, and the source control drawing shall follow the nomenclature. When the drawing number for a part is different than the part number (excluding dash number differences), the drawing number shall follow the description. When a part is authorized for local manufacture, and a specific drawing is required for such accomplishment, the drawing number shall follow the description. When only a model or type number identifies component, such a number shall be used in lieu of a part number.

6.3.3.1 Commercial Hardware. Commercial hardware procurable from normal commercial sources is identified with the letters COML in the part number column. When ordering the part, the complete description must be given.

6.3.3.2 Part Not Illustrated. Parts, which are indexed in the listing but are not shown on the illustration, shall have a dash (-) preceding the index number.

6.3.3.3 Marking. Decalcomanias, metalcals, vinyl film markings, etc., shall be considered as parts. The identifying drawing number for each marking shall appear in the Part Number column. The part number for each marking shall be followed (flush right) by an asterisk (*) symbol and means requisition this marking in accordance with the requirements of AFI 37-162. The nomenclature or title of each marking shall appear in the description column. The location of each marking shall be illustrated, but a separate readable illustration is not necessary.

6.3.3.4 Government Furnished Equipment (GFE) And Contractor Furnished Equipment (CFE) Covered by Separate Manuals. Following the part number of a Government Furnished Equipment (GFE) or Contractor Furnished Equipment (CFE) item, a number (#) symbol shall be inserted flush right. This symbol means that detail parts are listed in a separate manual.

6.3.4 CAGE Column. When a CAGE code for the appropriate design activity or government agency is not published in the current issues of the H4/H8 Cataloging Handbooks, the word NONE shall be inserted in the CAGE column directly opposite the part, model or type number listed in the part number column. When the word NONE is listed in the CAGE column, the complete name and address of the design activity or government agency, whose part, model or type number appears in the part number column, shall be shown in parenthesis at the end of the description. When several CAGE codes are not available, or the design activity's name and address must be repeated several times, numerically identified footnotes may be used in the CAGE column and identified at the end of the MPL.

6.3.5 Description Column. This column contains the description of each part listed. The identifying noun shall be the first word. The size, dimensions, material, and tolerances for a part shall be indicated to make the description complete. When the listing is an assembly or installation, the word ASSEMBLY or INSTALLATION shall follow the noun. A comma shall separate these words for the balance of the description. When units of measure are the same, they shall not be repeated with each dimension; example: 1/8 by 3/4 inch (not 1/8 inch by 3/4 inch). To avoid confusion, the dash shall be used between a whole number and a fraction; example 1-1/16. When a decimal with a value of less than 1.0 is given, a zero shall precede the decimal point; example: 0.002 inch. The appropriate numbers for the type, model, specification, specification control drawing, and the source control drawing shall follow the nomenclature. When the drawing number for a part is different than the part number (excluding dash number differences), the drawing number shall follow the description. When a part is authorized for local manufacture, and a specific drawing is required for such accomplishment, the drawing number shall follow the description. Reference to another illustration for information on the detail parts of an assembly and reference to another illustration for information on the NHA shall be made. Attaching parts shall be identified by the abbreviation (AP) following the description of the part.

6.3.5.1 Indentation. Parts listed in the MPL are indented to indicate item relationship or Next Higher Assembly (NHA). Nomenclature of each assembly is followed in the list (except for attaching parts) by nomenclature of its component indented one column to the right. This indentation indicates relationship of component to assembly. To determine NHA of a part or assembly, note column in which the first word of nomenclature appears. First item directly above, which appears one column to the left (except for attaching parts), is NHA.

Description

1 2 3 4 5 6 7

END ITEM, COMPONENT, MAJOR ASSEMBLY
. HCI DETAIL PARTS FOR END ITEM, COMPONENT, MAJOR ASSEMBLY
. Assembly
. . Attaching Parts for Assembly (AP)
. . ⌬ Detail Parts for Assembly
. . Subassemblies
. . Attaching Parts for Subassemblies (AP)
. . . Detail Parts for Subassemblies
. . . Sub-subassemblies
. . . Attaching Parts for Sub-Subassemblies (AP)
. . . . Detail Parts for Sub-subassemblies

6.3.5.2 Cross-Reference.

a. The notation (See Figure _____ for detail bkdn) following description of a part number indicates that further breakdown of part will be shown on figure noted.

b. The notation (See Figure _____ for NHA) following description of a part number indicates that the correct assembly relationship of the part will be shown on the figure and index noted.

c. The notation (Intchg with ____) is used when two or more parts are dimensionally and functionally interchangeable and none are preferred over the other. Notation is shown in the description column of all such interchangeable parts.

d. The notation (Use only on (part number)) following description of a part number indicates that part is used only on part number indicated.

e. The notation (When exh, use ____) following description of a part number indicates an improved or redesigned part has been developed and replaced part is still authorized for continued use until stock is depleted.

6.3.6 Units Per Assembly Column. Quantity shown in this column represents units required for each detail part in an assembly, each assembly in the NHA, and each attaching part to attach one unit or one assembly. The abbreviation AR (as required) is used when quantity required must be determined when parts are installed. The abbreviation REF (reference) indicates that item has been previously listed under its NHA. The SEE FIGURE notation in description of item will indicate figure and index number at which units per assembly can be determined.

6.3.7 Usable On Code Column. This column contains codes to indicate the configuration of the end items to which listed assemblies and parts apply. No code is required in this column if a part applies to all configurations or the manual covers only one configuration. The coding system shall consist of letters of the alphabet beginning with single letters; example: A, B, C, and continues with double letters AA, AB, AC, when necessary.

6.3.8 Source, Maintenance, and Recoverability (SMR) Code Column. This column shall contain the five-digit Joint Military Services Uniform SMR codes.

6.3.9 Numerical Index. The numerical index is required when the MPL contains 200 or more different part numbers. The numerical index contains the part numbers of all parts listed in the MPL, including model and type numbers for components not assigned part numbers.

6.3.9.1 Part Number Column. Part number arrangement shall begin at the extreme left and continue from left to right, one position at a time. For the first character of the part number, the letters A through N and P through Z take precedence over the numerals, 0 through 9. (Alphabetic Os are considered numeric zeros.) For the second and succeeding characters of a part number, precedence is as follows: (1) diagonal, (2) period, (3) dash, (4) letters A through N and P through Z, and (5) numerals, 0 through 9.

6.3.9.2 Figure and Index Number Column. This column contains the figure and index numbers for all parts listed, if applicable. When an assembly or part has not been assigned an index number, the figure and index number of the preceding part in the MPL shall be used with the letter F before the figure number, such as F7-6. The letter F means follows.

6.3.10 Reference Designator Index. This index is required only when reference designators have been established for any parts listed in the MPL. When the MPL contains less than 200 different part numbers, a reference designator index is not required, and the applicable reference designators have been inserted on the illustrations.

6.3.10.1 Reference Designator Column. This column contains all applicable reference designators shown on schematic and wiring diagrams and those cited in applicable operation and maintenance manuals. Reference designators are arranged in alphanumeric sequence. When the block or unit system of designations is employed, identical items having reference designators that are consecutive, and are at the same location, may be grouped.

6.3.10.2 Figure and Index Number Column. This column contains the figure and index numbers applicable to all reference designations listed. When an assembly or part has a reference designator, but not an index number, the figure and index number of the preceding part in the MPL shall be used with the letter F before the figure number, such as F7-6. The letter F means follows.

6.4 SIMILAR ASSEMBLIES.

Similar assemblies, which contain a majority of identical parts, are combined and listed as follows; otherwise, assemblies are listed separately:

a. Similar assembly part numbers are listed first, followed by detail parts.

b. A part common to all assemblies in the same quantity is listed once.

c. A part common to all assemblies in differing quantities is listed once for each quantity and identified with Use on _____ note to which assembly it pertains.

d. Peculiar parts are listed once and identified with Use only on _____ note to which assembly it pertains.

6.5 QUICK CHANGE UNITS/REPAIR PARTS KITS.

When replaceable parts of an assembly are available in the form of kids, the words REPAIR KIT AVAILABLE shall follow the description of the applicable assembly. The detail parts

of the assembly that are contained in the kit shall be assigned kit source codes and these codes shall appear in the description column. Illustrations of kits are not required.

Repair parts kits have not been provisioned for this item. Certain replacement parts are stocked only in kits. Standard parts and parts having multi-application are stocked in their appropriate classes and may also be stocked in kits. Kit parts should not be ordered from separate stock to make up a kit.

When an item is supported by a Quick Change Unit, the words QCU AVAILABLE shall follow the description of the applicable item. The detail parts of the item that are contained in the QCU shall be identified with the words QCU DETAIL following the description of each detail part. The QCU listing shall follow the last detail part of the applicable item and be listed at the same indentation as the item. Following the listing of the QCU, a quick change kit, if applicable shall be listed. Illustrations of QCUs are not required.

6.6 SHEET NUMBER EXPLANATION.

If multiple sheet illustrations are used, the sheet number follows the index number and is separated with a slash (/). Figure 12, index 1, on sheet two of the illustration would be listed as 12 1/2. When an indexed item appears on more than one sheet of the illustration, the first and last sheet number on which the item appears shall be listed.

6.7 USABLE ON CODES.

When two or more assemblies are listed in the same parts list, a code letter (A, B, etc.) is assigned to each main assembly. All subcomponents, peculiar to a particular assembly, are identified by the same code letter as the main assembly. If parts are common to all assemblies covered, the Usable on Code column is left blank.

6.8 SOURCE, MAINTENANCE, AND RECOVERABILITY (SMR) CODES.

WARNING

When certain components and assemblies of the Liquid Oxygen Converter, P/N 50C-0021-1, are replaced, it must be certified beyond doubt that the replacement items have been thoroughly cleaned in accordance with procedures established for oxygen compatibility.

This manual contains Joint Military Service Uniform Source, Maintenance, and Recoverability (SMR) codes. Definitions of these SMR codes are available in TO 00-25-195.

6.9 NUCLEAR HARDNESS.

CAUTION

The HCI symbol emphasizes the uniqueness of hardness features and establishes special requirements limiting changes and substitutions, and that specific parts listed must be used to ensure hardness is not degraded.

If equipment covered has nuclear survivability requirements, all Hardness Critical Items (HCI) shall be marked. When the part is identified as HCI, the symbol [HCI] shall immediately precede the description of the item. When approved by the acquiring activity, the symbol **HCI** may be used in lieu of the boxed HCI symbol.

6.10 ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) PARTS.

CAUTION

The ESDS symbol requires that all ESDS parts be handled in accordance with the ESDS device handling procedures in TO 00-25-234.

If equipment covered contains ESDS parts, the parts shall be marked with the ESDS symbol ⏣ immediately preceding the description of the item. When approved by the acquiring activity, the symbol **ESD** may be used in lieu of the ESDS symbol.

6.11 PARTS STANDARDIZATION.

Authority for use of a part number different than the part number listed in this IPB is established by the Department of Defense (DoD) Interchangeability and Substitution (I&S) Program. Refer to the D043B Master Item Identification Base for Air Force I&S information. The maintenance technician has final responsibility and authority for determining acceptability of substitute parts.

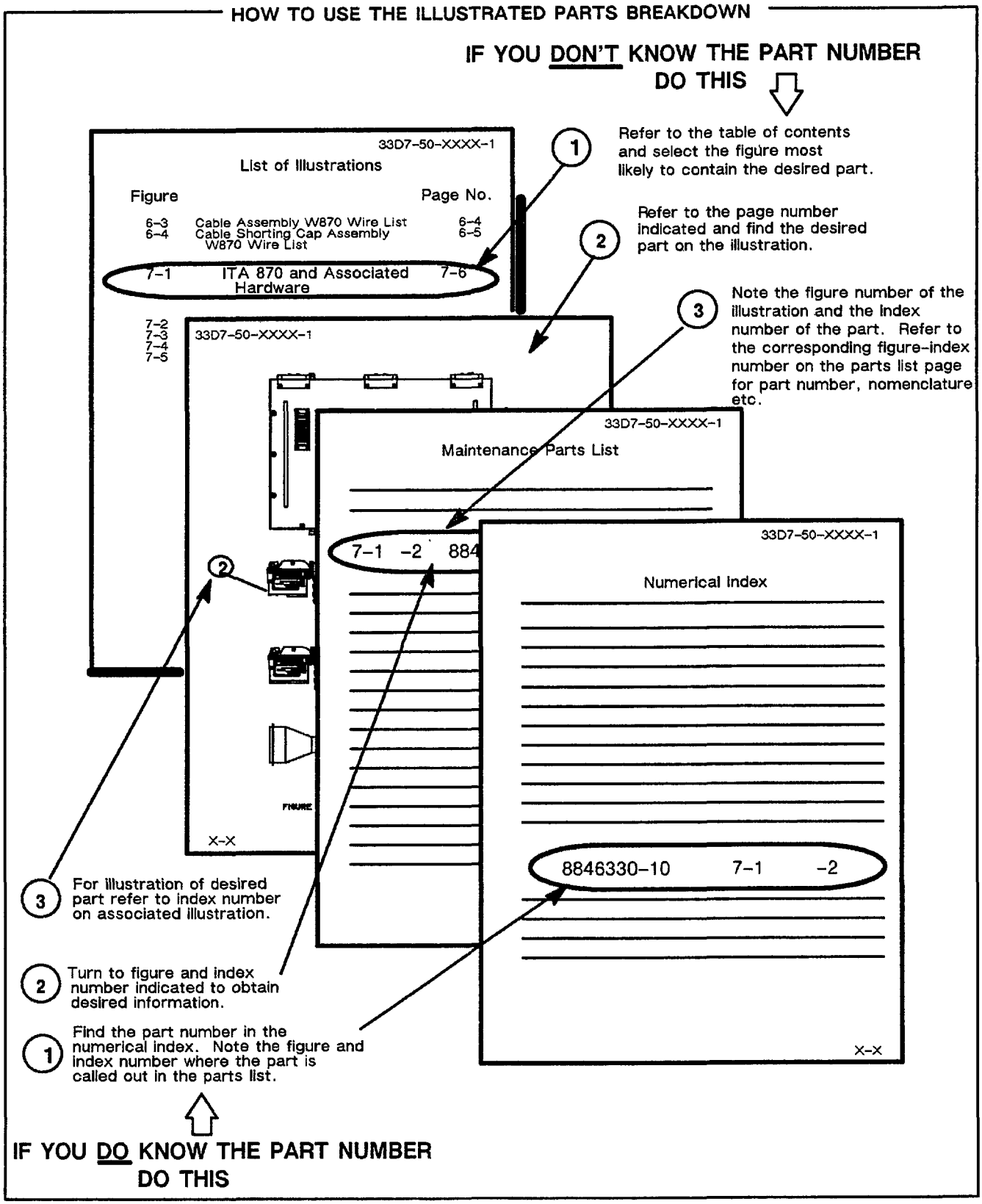
Authority for use of a part number different than the part number listed in this IPB shall be approved in writing by the cognizant engineering agency responsible for configuration control.

6.12 COMMERCIAL AND GOVERNMENT ENTITY (CAGE).

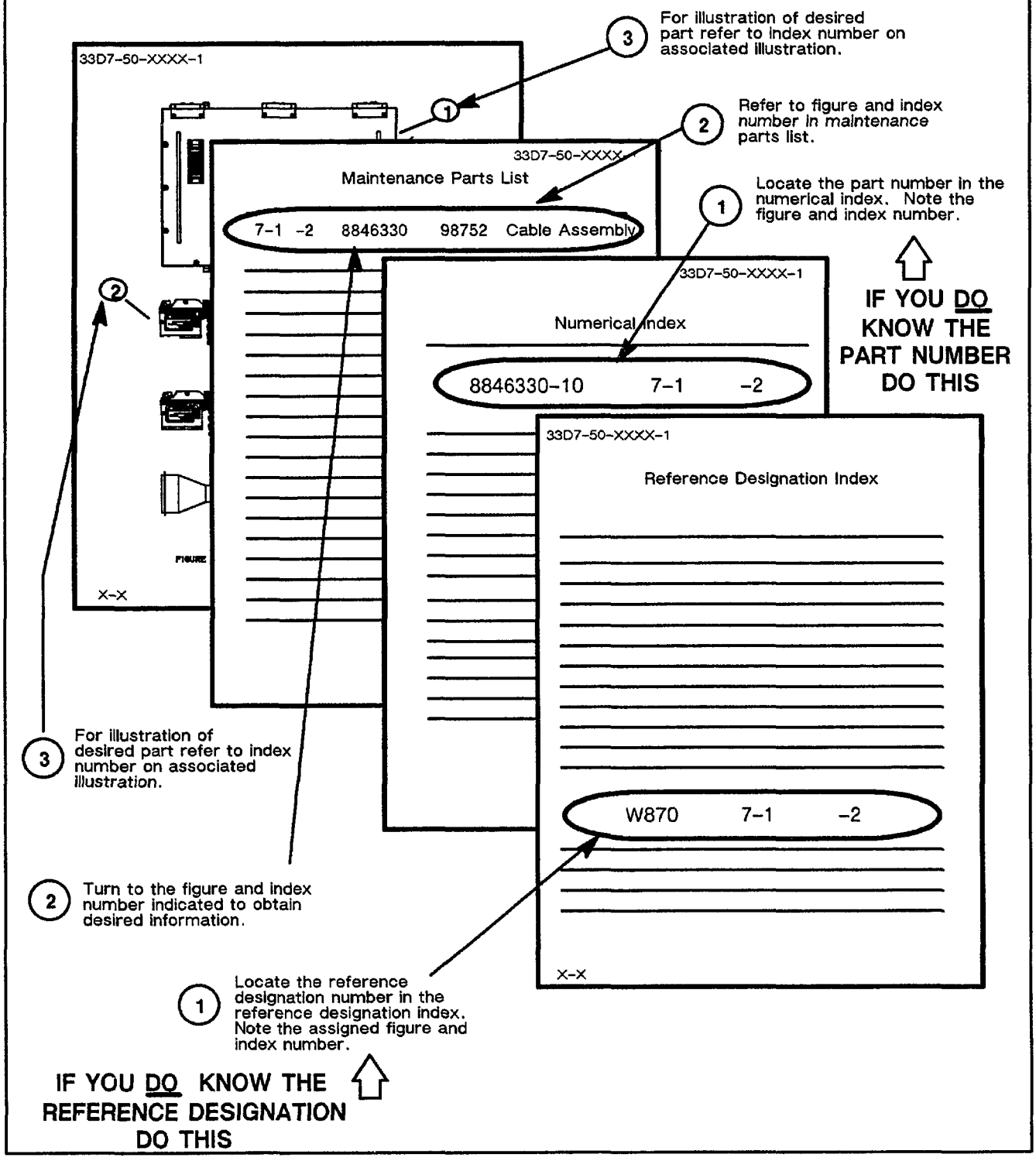
The following codes are in accordance with H4/H8 Cataloging Handbooks, Commercial and Government Entity.

CAGE CODE	MANUFACTURERS' NAME AND ADDRESS
04963	3M Adhesives Div. St. Paul MN 55144
11076	Ohio Medical Products Division of BOC Group 1801 West 16th Street Broadview, IL 60153
18677	Scanbe Division of Zero Corp. 3445-T Flecher Avenue El Monte, CA 91731
2W222	Drexelbrook Engineering 205 Keith Valley Road Horsham, PA 19044
80063	Army Communications & Electronics Readiness Command Logistic Engineering Directorate Fort Mammouth, NJ 07703
83533	Essex Industries, Inc. 6 Sunnen Drive St. Louis, MO 63143
88044	Aeronautical Standards Group Dept. of Navy and USAF
98388	Accurate Products Div. of Lear Siegler 4370 Jutland Drive San Diego, CA 92117
96906	Department of Defense
94222	Southco Inc. P.O. Box 0116 210 N. Brinton Lake Road Concordville, PA 19331
98313	Davis Aircraft Products Co., Inc. 1150 Walnut Ave. Bohemia, NY 11716
98376	Zero Corp. (West) 500 West 200 North North Salt Lake, UT 84054
98750	Dept. of the Air Force Headquarters, San Antonio Air Logistics Center (SA-ALC) Kelly Air Force Base, TX 78241-5000
19602	Essex Cryogenics of MO. Inc 8007 Chivvis Drive Affton, MO 63123

HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN


IF YOU DON'T KNOW THE PART NUMBER
DO THIS
33D7-50-XXXX-1
List of Illustrations
Figure
Page No.
6-3 Cable Assembly W870 Wire List 6-4
6-4 Cable Shorting Cap Assembly W870 Wire List 6-5
7-1 ITA 870 and Associated Hardware 7-6
1
Refer to the table of contents and select the figure most likely to contain the desired part.
2
Refer to the page number indicated and find the desired part on the illustration.
3
Note the figure number of the illustration and the index number of the part. Refer to the corresponding figure-index number on the parts list page for part number, nomenclature etc.
7-2
7-3
7-4
7-5
33D7-50-XXXX-1
X-X
33D7-50-XXXX-1
Maintenance Parts List
7-1 -2 884
33D7-50-XXXX-1
Numerical Index
8846330-10 7-1 -2
X-X
3
For illustration of desired part refer to index number on associated illustration.
2
Turn to figure and index number indicated to obtain desired information.
1
Find the part number in the numerical index. Note the figure and index number where the part is called out in the parts list.
IF YOU DO KNOW THE PART NUMBER
DO THIS

HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN


33D7-50-XXXX-1
3
For illustration of desired part refer to index number on associated illustration.
1
2
Refer to figure and index number in maintenance parts list.
33D7-50-XXXX
Maintenance Parts List
7-1 -2 8846330 98752 Cable Assembly
1
Locate the part number in the numerical index. Note the figure and index number.
33D7-50-XXXX-1
Numerical Index
8846330-10 7-1 -2
IF YOU DO KNOW THE PART NUMBER DO THIS
33D7-50-XXXX-1
Reference Designation Index
W870 7-1 -2
X-X
2
3
For illustration of desired part refer to index number on associated illustration.
2
Turn to the figure and index number indicated to obtain desired information.
1
Locate the reference designation number in the reference designation index. Note the assigned figure and index number.
IF YOU DO KNOW THE REFERENCE DESIGNATION DO THIS

SECTION II
MAINTENANCE PARTS LIST

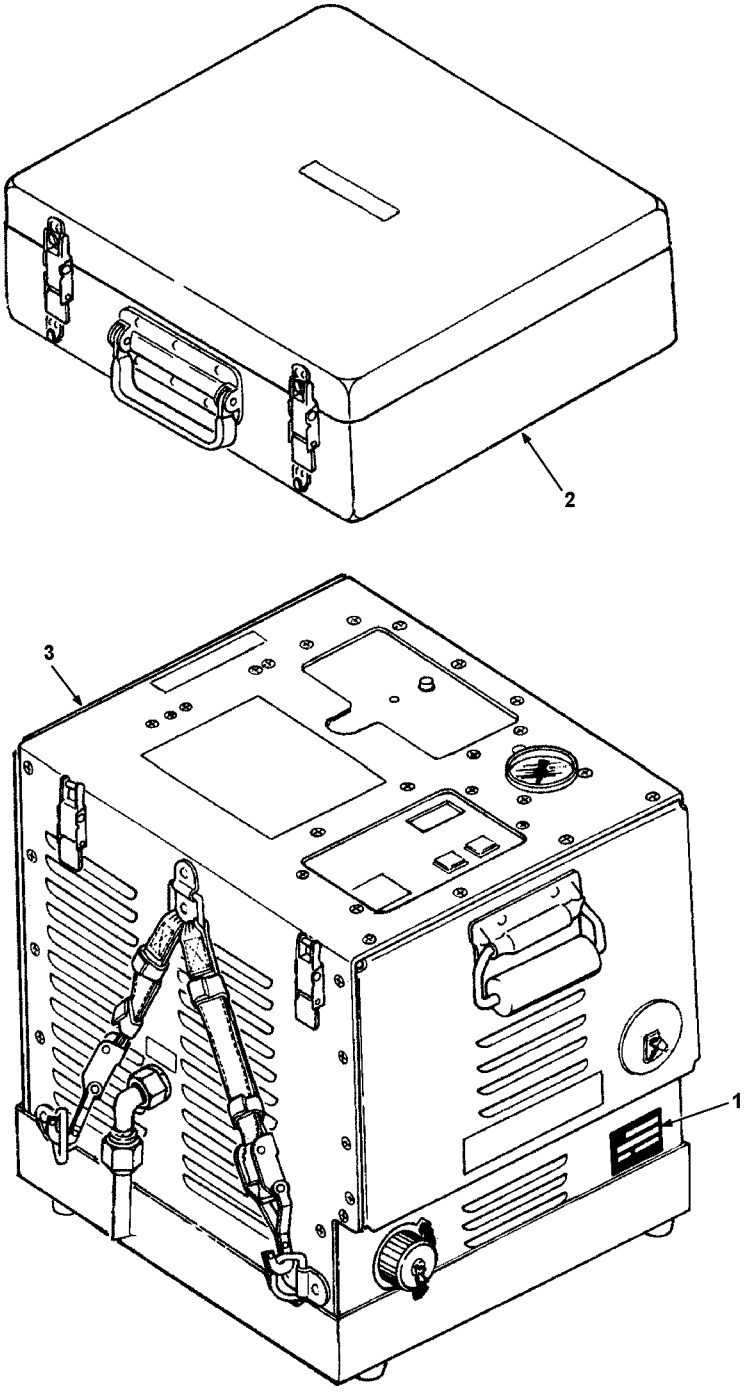


Figure 6-1. Converter, Liquid Oxygen, P/N 50C-0021-1

FIGURE & INDEX/ SHEET NO.	PART NUMBER	CAGE	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE	SMR CODE
6-1	50C-0021-1	19062	CONVERTER, Liquid Oxygen	1		ADO
1	50C-0021-0059	19062	. PLATE, Identification (Alloy Foil Type I - Pressure Sensitive Adhesive Back)	1		XC
2	50C-0021-0001	19062	. KIT ASSEMBLY, Accessory	1		ADO
3	50C-0021-0020	19062	. CONTAINER ASSEMBLY, Liquid Oxygen	1		XC

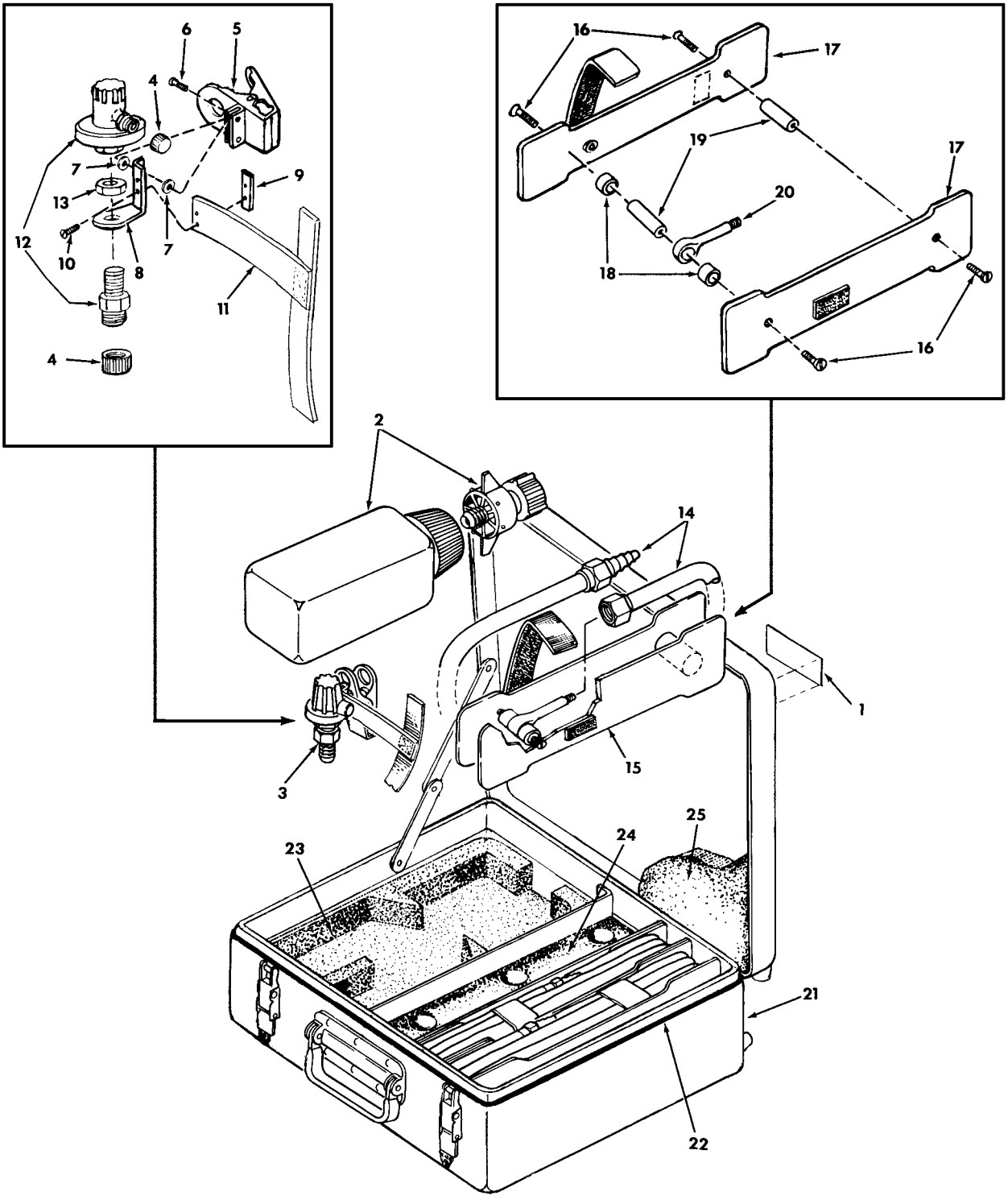


Figure 6-2. Accessory Case Assembly - Exploded View

FIGURE & INDEX/ SHEET NO.	PART NUMBER	CAGE	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE	SMR CODE
6-2	8661076-10	98750	KIT ASSEMBLY, Accessory	1		ADO
1	8661141-01*	98750	. PLATE, Instruction (Alloy Foil Type I - Pressure Sensitive Adhesive Back)	1		XC
2	8661087	98750	. KIT, Humidification, 500 ml (Only three Humidification Kits are required per Accessory Kit. Three different Humidification Kit configurations are available. Three Humidification Kits from the same Vendor must be used when assembling the Accessory Kit)	3		PAOZZ
	8661088	98750	. KIT, Humidification, 500 ml (Only three Humidification Kits are required per Accessory Kit. Three different Humidification Kit configurations are available. Three Humidification Kits from the same Vendor must be used when assembling the Accessory Kit)	3		PAOZZ
	8661089	98750	. KIT, Humidification, 500 ml (Only three Humidification Kits are required per Accessory Kit. Three different Humidification Kit configurations are available. Three Humidification Kits from the same Vendor must be used when assembling the Accessory Kit)	3		PAOZZ
3	8661082-10	98750	. VALVE/CLIP ASSEMBLY	3		PAOOO
4	NAS817-6	80205	. . CAP, Shipping	2		PAOZZ
5	MS22058-17	96906	. . CLIP ASSEMBLY, Type1	1		PAOZZ
6	MS24693-C203	96906	. . SCREW Machine, Countersunk (AP)	2		PAOZZ
7	AN960PD-4	88044	. . WASHER, Flat (AP)	4		PAOZZ
8	8661084-01	98750	. . BRACKET, Flow Control Valve	1		PAOOO
9	8661086-01	98750	. . PLATE, Flow Control Valve	1		MOO
10	MS24694-C203	96906	. . SCREW, Machine, Countersunk (AP)	2		PAOZZ
11	8661085-10	98750	. . STRAP ASSEMBLY, Flow Control Valve	1		PAOOO
12	8661083-01	98750	. . VALVE, Flow Control	1		PAOZZ
	110450100-1	83533	. . . FITTING, Inlet Filter			XA
13	TSE02-13	95208	. . NUT, Locking	1		PAOZZ
14	231-1418-810	11076	. HOSE ASSEMBLY, Oxygen (20 ft.)	3		PAOZZ
15	8661091-10	98750	. RACK ASSEMBLY, Hose	3		PAOZZ
16	MS24693-C272	96906	. . SCREW, Machine, Countersunk	4		PAOZZ
17	8661092-01	98750	. . PLATE, Hose Rack	2		AFF
	8661125-10	98750	. . STRAP, Hose Rack	1		MOO
	MS16535-156	96906	. . RIVET, Tubular, Oval Head	1		PAOZZ
	AN960PD-4L	88044	. . WASHER, Flat	1		PAOZZ
18	8661095-01	98750	. . SLEEVE	2		AFF
19	8661094-01	98750	. . SPACER	2		AFF
20	8661093-01	98750	. . SWIVEL, Hose Attachment	1		AFF
	8661091-01	98750	. . STRAP	2		MOO
21	8661077-10	98750	. CASE ASEMBLY, Accessory	1		PBOOO
22	ZP21280	98376	. . SEAL (44.00 lg)	1		PAOZZ
23	8661079-01	98750	. . INSERT Humidifier	1		MFF
24	8661080-01	98750	. . INSERT Control Valve	1		MFF
25	8661081-01	98750	. . INSERT, Lid	1		MFF
	45-NF CLEAR	04963	. . ADHESIVE	AR		PAOZZ
	1300L	04963	. . ADHESIVE, Rubber & Gasket	AR		PAOZZ
	10652	98376	. . BRACKET, Stay Bolt	1		PBOZZ
	10621	98376	. . SCREW, Shoulder Cap	2		PAOZZ
	AN960-416L	88044	. . WASHER, Flat (AP)	2		PAOZZ
	MS18015-2	96906	. . LATCH	2		PBOZZ

FIGURE & INDEX/ SHEET NO.	PART NUMBER	CAGE	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE	SMR CODE
6-2 25	MS20470AD4-6	96906	. . RIVET, Solid, Universal Head (AP)	2		PAOZZ
	MS18015-3	96906	. . STRIKE	6		PBOZZ
	MS20470AD4-6	96906	. . RIVET, Solid, Universal Head (AP)	2		PAOZZ
	ZSP3-304-3	98376	. . HANDLE	1		PAOZZ
	MS20470AD4-6	96906	. . RIVET, Solid, Universal Head (AP)	6		PAOZZ
	2813	98388	. . FOOT	4		PAOZZ
	MS16535-176	96906	. . RIVET(AP)	1		PAOZZ
	8661078-01	98750	. . CASE	1		PBOOO

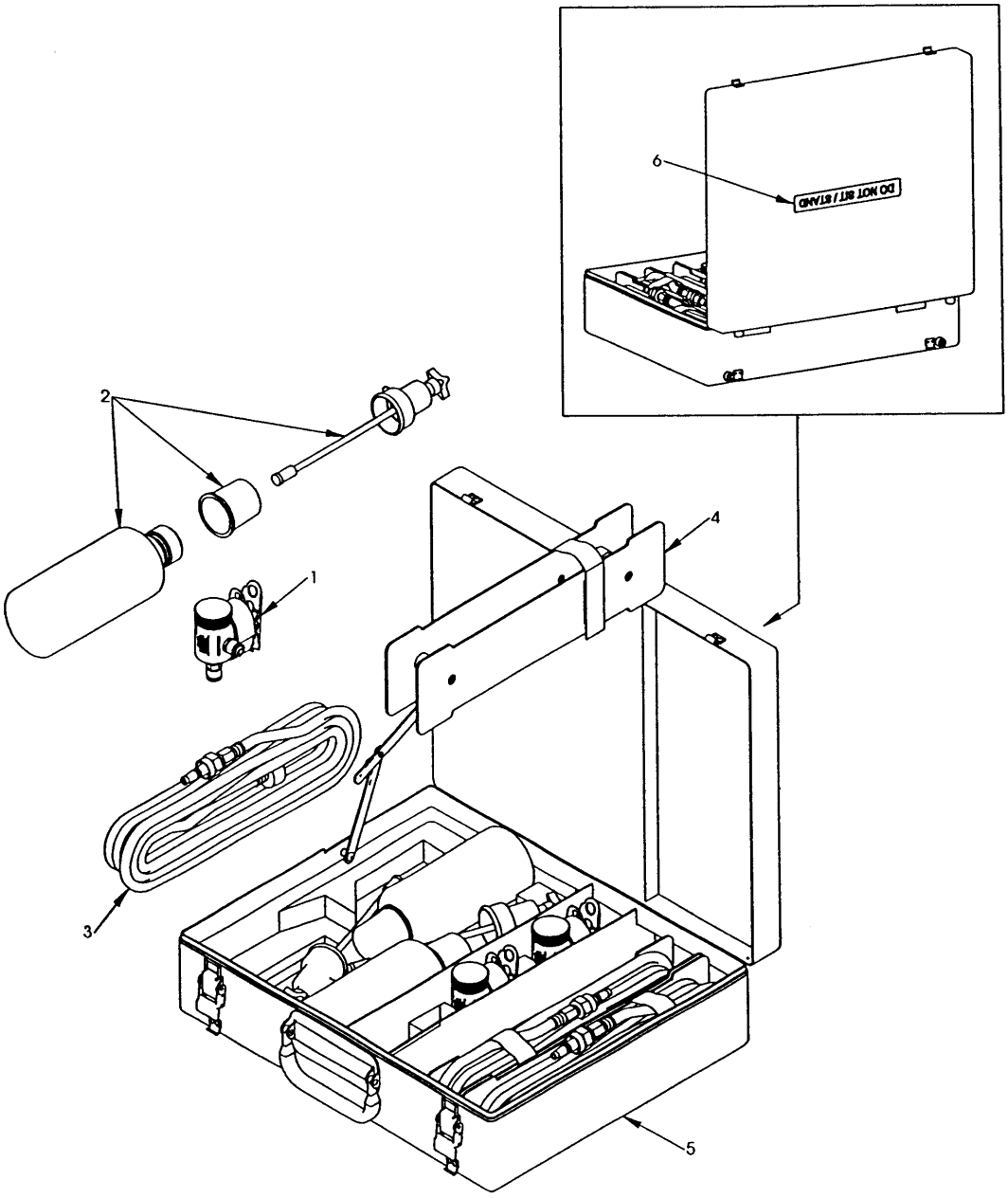


Figure 6-3. Accessory Case Assembly

FIGURE & INDEX/ SHEET NO.	PART NUMBER	CAGE	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE	SMR CODE
6-3	50C-0021-0001	19062	KIT ASSEMBLY, Accessory	1		AFO
1	50C-0021-0006	19062	. VALVE/CLIP ASSEMBLY	3		XB
2	50C-0021-0012	19062	. KIT, Humidification, 500 ml	3		XB
3	50C-0021-0013	19062	. HOSE ASSEMBLY, Oxygen (20 ft)	3		XB
4	50C-0021-0014	19062	. RACK ASSEMBLY, Hose	1		XB
5	50C-0021-0073	19062	. CASE ASSEMBLY, Accessory	1		XB
6	50C-0021-0069	19062	. PLATE, Instruction (Alloy Foil Type I - Pressure Sensitive Adhesive Back)	1		XB

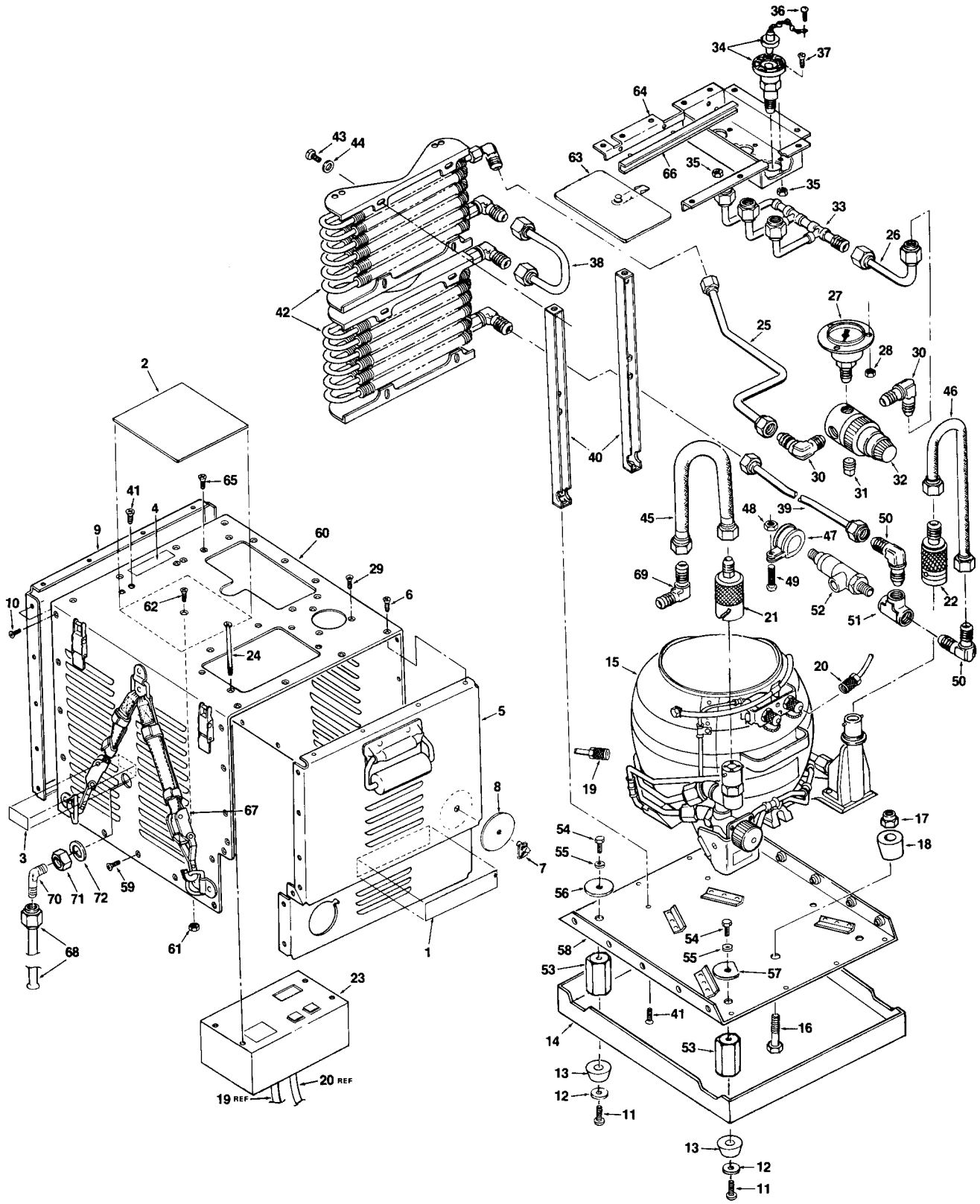


Figure 6-4. Liquid Oxygen System Assembly - Exploded View

FIGURE & INDEX/ SHEET NO.	PART NUMBER	CAGE	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE	SMR CODE
6-4	50C-0021-0020	19062	CONTAINER ASSEMBLY, Liquid Oxygen	1		ADF
1	10C-0001-0033	19062	. PLATE, Caution (Alloy Foil Type I - Pressure Sensitive Adhesive Back)	1		XC
2	50C-0021-0057	19062	. PLATE, Instruction (Alloy Foil Type I - Pressure Sensitive Adhesive Back)	1		XC
3	8C-0014-0010	19062	. PLATE, Overboard Vent (Alloy Foil Type I - Pressure Sensitive Adhesive Back)	1		XC
4	50C-0021-0069	19062	. PLATE, Instruction (Alloy Foil Type I - Pressure Sensitive Adhesive Back)	1		XC
5	50C-0021-0026	19062	. PANEL ASSEMBLY, Front	1		AFF
6	MS24693-C49		. SCREW, Machine, Countersunk (AP)	22		PAOZZ
	M45938/11-6CL		. NUT, Plain, Self-Locking Clinch	22		PAOZZ
	MS18012-5		. . HANDLE	1		PAOZZ
	MS20470AD5-7		. . RIVET, Universal Head (AP)	5		PAOZZ
7	MS90298-2		. CONNECTOR	1		PAFZZ
8	M83413/9-1		. PLATE	1		XC
9	50C-0021-0024	19062	. PANEL ASSEMBLY, Rear	1		AFF
10	MS24693-C49		. SCREW, Machine, Countersunk (AP)	18		PAOZZ
	M45938/11-6CL		. NUT, Plain, Self-Locking Clinch	18		PAOZZ
	MS18012-5		. . HANDLE	1		PAOZZ
	MS20470AD5-7		. . RIVET, Universal Head (AP)	5		PAOZZ
11	MS51957-45		. SCREW	4		PAOZZ
12	MS35338-137		. WASHER	4		PAOZZ
13	8C-0308-0001	19062	. FOOT	4		PAOZZ
14	50C-0021-0078	19062	. PAN	1		AFF
15	10C-0016-16	19062	. CONVERTER, Liquid Oxygen	1		PAFZZ
16	MS24693-C301		. SCREW, Machine, Countersunk (AP)	1		PAOZZ
17	MS21044-C4		. NUT, Self Locking (AP)	1		PAOZZ
18	50C-0021-0051	19062	. RETAINER, Converter (AP)	1		PAFZZ
19	50C-0021-0064	19062	. CABLE ASSEMBLY, Capacitance E Polarity	1		PAFZZ
20	50C-0021-0065	19062	. CABLE ASSEMBLY, Capacitance B Polarity	1		PAFZZ
21	256000-7	19062	. COUPLING, Quick Disconnect	1		PAFZZ
22	258000-7	19062	. COUPLING, Quick Disconnect	1		PBFFF
23	50C-0021-0048	19062	. INDICATOR, Liquid Oxygen Quantity, 10 Liter	1		PAFZZ
24	MS24693-C64		. SCREW, Machine, Countersunk (AP)	4		PAOZZ
	899-160-102	2W222	. . GASKET, Battery Compartment	1		MFF
	BA-3090/U	80063	. . BATTERY, Dry, 9-volt D. C	2		PAOZZ
25	50C-0021-0055	19062	. TUBE ASSEMBLY, Regulator Supply	1		MFF
26	50C-0021-0053	19062	. TUBE ASSEMBLY, Manifold Supply	1		MFF
27	50C-0021-0046	19062	. GAUGE, Pressure	1		PAFZZ
28	MS21044-D06		. NUT, Self Locking (AP)	1		PAOZZ
29	MS24693-C29		. SCREW, Machine, Countersunk (AP)	1		PAOZZ
30	MS20822-5D		. ELBOW	2		XB
31	MS20913-1D		. PLUG	1		XB
32	50C-0021-0047	19062	. REGULATOR, Miniature	1		PAOZZ
33	50C-0021-0040	19062	. MANIFOLD	1		MFF
34	M7891LF-3		. VALVE, Filler, Low Pressure, Oxygen	1		PAOZZ
35	MS21044-D08		. NUT, Self Locking (AP)	4		PAOZZ
36	MS51957-46		. SCREW, Machine, Pan Head (AP)	1		PAOZZ
37	MS24693-C50		. SCREW, Machine, Countersunk (AP)	3		PAOZZ
38	50C-0021-0054	19062	. TUBE ASSEMBLY, Heat Exchanger	1		MFF

FIGURE & INDEX/ SHEET NO.	PART NUMBER	CAGE	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE	SMR CODE
6-4 39	50C-0021-0052	19062	. TUBE ASSEMBLY Supply,	1		MFF
40	50C-0021-0039	19062	. SUPPORT, Heat Exchanger	2		XB
41	MS24693-C49		. SCREW, Machine, Countersunk (AP)	2		PAOZZ
	M45938/11-6CL		. NUT, Plain, Self-Locking Clinch	2		PAOZZ
42	50C-0007-2	19062	. EXCHANGER ASSEMBLY, Heat	2		PAOZZ
43	MS51957-44		. SCREW, Machine, Pan Head (AP)	4		PAOZZ
44	NAS1149CN832R		. WASHER, Flat (AP) (Replaces inactive P/N AN96C8 per National Aerospace Standard. Existing AN960 stock may be used until depleted)	4		PAOZZ
	M45938/11-6CL		. NUT, Plain, Self-Locking Clinch	4		PAOZZ
45	MS24548-8-18		. HOSE ASSEMBLY	1		PAFZZ
46	MS24548-5-18		. HOSE ASSEMBLY	1		PAFZZ
47	MS21919WDG-14		. CLAMP	1		PAOZZ
48	MS21044-D08		. NUT, Self Locking (AP)	1		PAOZZ
49	MS24693-C50		. SCREW, Machine, Countersunk (AP)	1		PAOZZ
50	MS20822-5D		. ELBOW	2		XB
51	AN917-1D		. TEE	1		PAFZZ
52	20C-0050-5		. VALVE, Oxygen, Pressure Relief	1		PAFFF
53	50C-0021-0079	19062	. SPACER, Pan	4		PAFZZ
54	MS35307-303		. SCREW	4		PAOZZ
55	MS35338-139		. WASHER	4		PAOZZ
56	50C-0021-0081	19062	. WASHER, Flat	3		MFF
57	50C-0021-0080	19062	. WASHER, Flat	1		MFF
58	50C-0021-0021	19062	. PANEL ASSEMBLY, Bottom	1		AFF
59	MS24693-C49		. SCREW, Machine, Countersunk (AP)	10		PAOZZ
	M45938/11-6CL		. NUT, Plain, Self-Locking Clinch	10		PAFZZ
	50C-0021-0023	19062	. . RESTRAINT, Converter	4		MFF
	MS20426AD5-6		. . RIVET, Solid, Countersunk(AP)	3		PAOZZ
60	50C-0021-0028	19062	. COVER ASSEMBLY	1		AFF
61	MS21044-D08		. NUT, Self Locking	1		PAOZZ
62	MS24693-C49		. SCREW, Machine, Countersunk.	1		PAOZZ
63	50C-0021-0033	19062	. . DOOR ASSEMBLY, Access	1		XB
	50C-0021-0035	19062	. . . CATCH, Push Release	1		XB
	MS20470AD6-6		. . . RIVET, Universal Head	1		PAOZZ
64	50C-0021-0031		. . HOUSING, Supply Disconnect	1		MFF
65	MS24693-C49	96906	. . SCREW, Machine, Countersunk (AP)	12		PAOZZ
	M45938/11-6CL	96906	. . NUT, Plain, Self-Locking Clinch	12		PAFZZ
66	50C-0021-0032	19062	. . GUIDE	2		XBFFF
67	50C-0021-0038	19062	. . STRAP ASSEMBLY, Tie Down	2		MFF
	50C-0021-0038-1	19062	. . . RING	2		PAFZZ
	50C-0021-0036	19062	. . . CLIP, Ring	2		PAFZZ
	MS20470AD6-6		. . . RIVET, Universal Head	12		PAOZZ
	MS18015-2		. . LATCH	4		PAOZZ
	MS20470AD4-6		. . RIVET, Universal Head	8		PAOZZ
	50C-0021-0038-2	19062	. . RING	4		PAFZZ
68	50C-0021-0072	19062	. TUBE ASSEMBLY, Vent	1		MFF
69	50C-0021-0061	19062	. ELBOW	1		PAFZZ
70	MS20822-6D		. ELBOW, Vent	1		XB
71	AN924-8D		. NUT, Bulkhead	1		PAOZZ
72	MS35335-68		. LOCKWASHER	1		PAOZZ